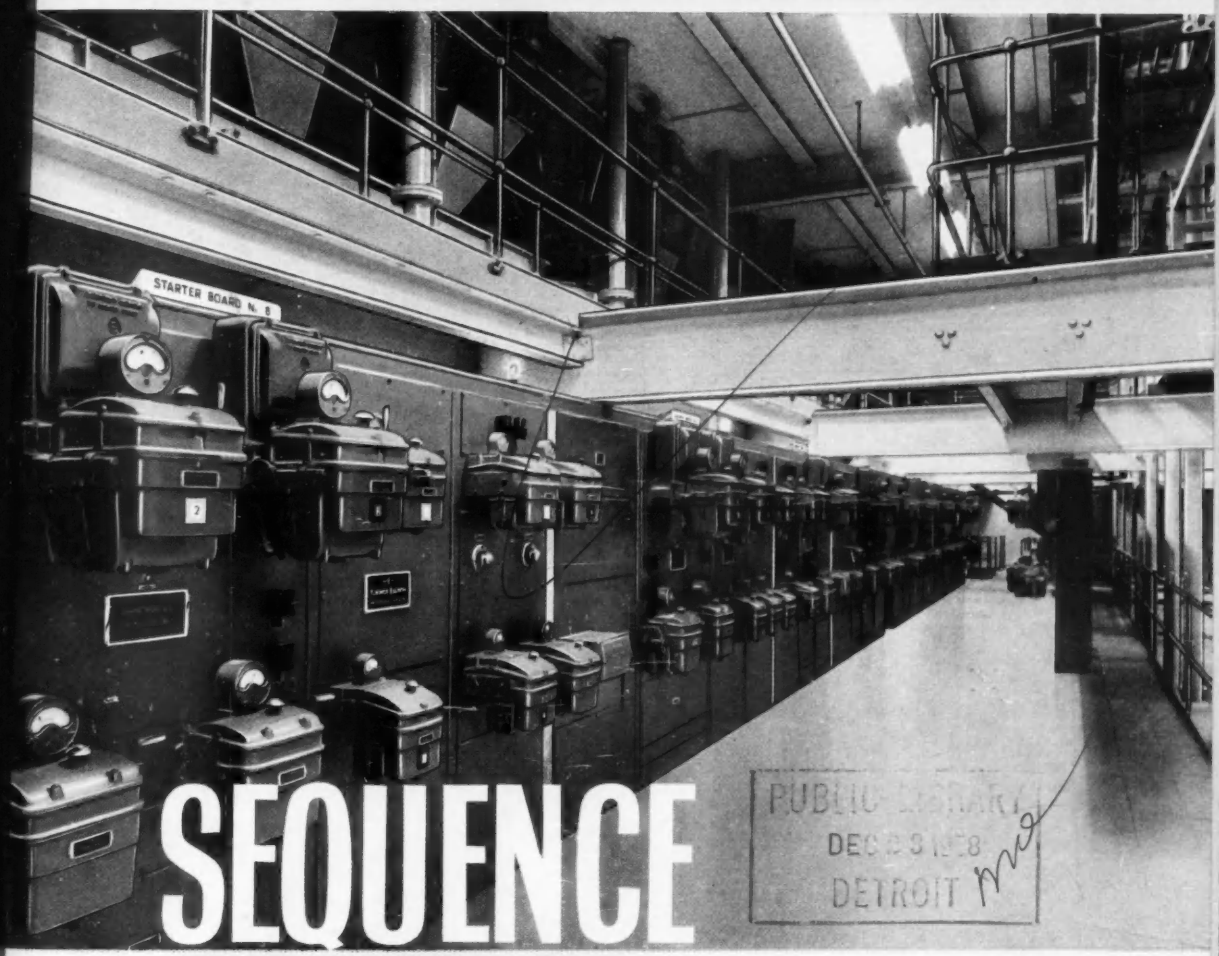
ELECTRICAL REVIEW

RIDAY
EMBER 1958

WEEKLY
PRICE 1s 6d



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DETROIT

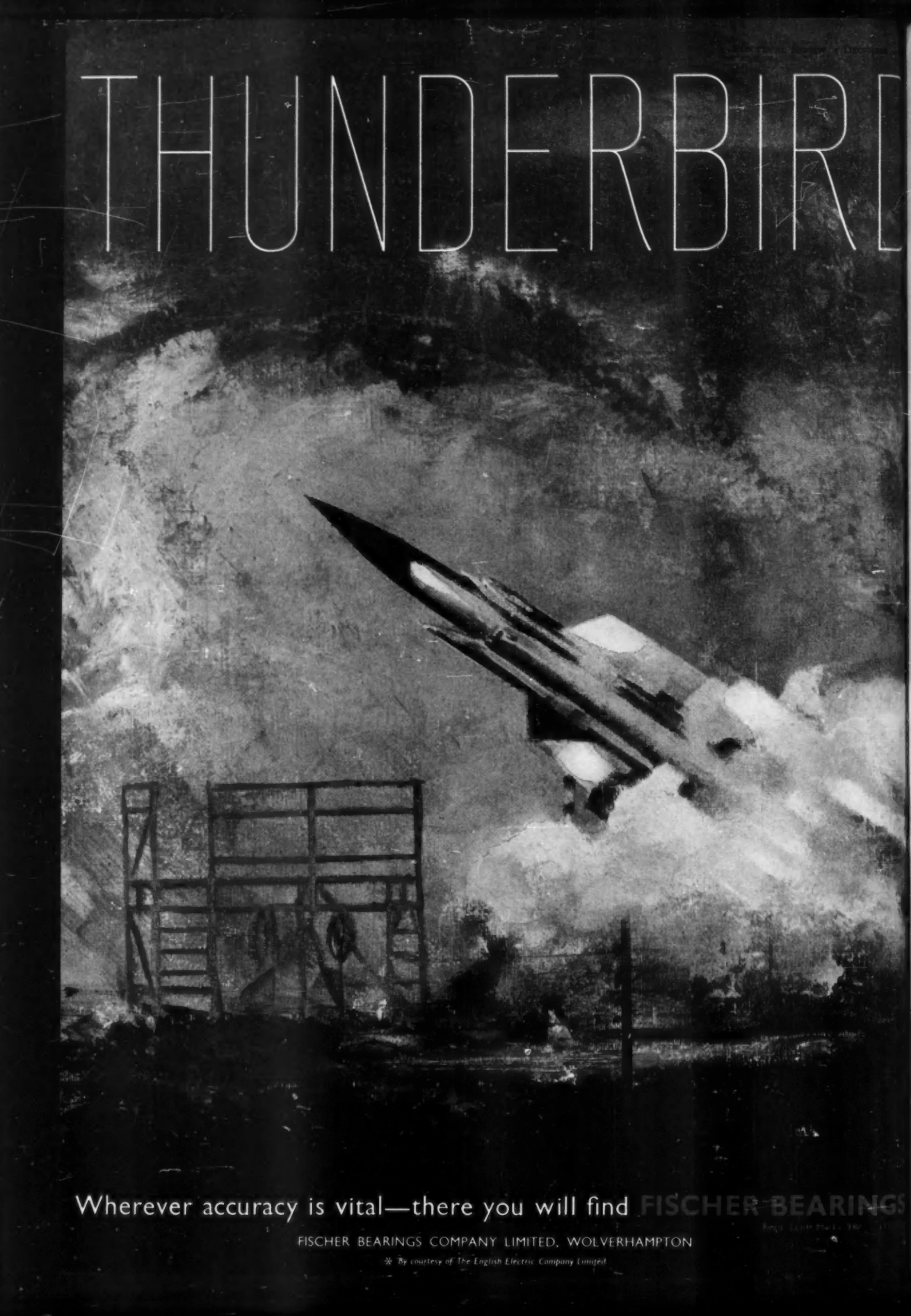
SEQUENCE CONTROL

Recent installations of "Ellison" Switchgear at The British Oil and Cake Mills Ltd., Selby, include these Sequence Control Switchboards that ensure the reliable flow of production materials. Thus a tradition is continued—a tradition that started nearly half a century ago when the first piece of Ellison Switchgear was installed in these works.

GEORGE ELLISON
LIMITED
BIRMINGHAM ENGLAND

Continuing a Tradition

615

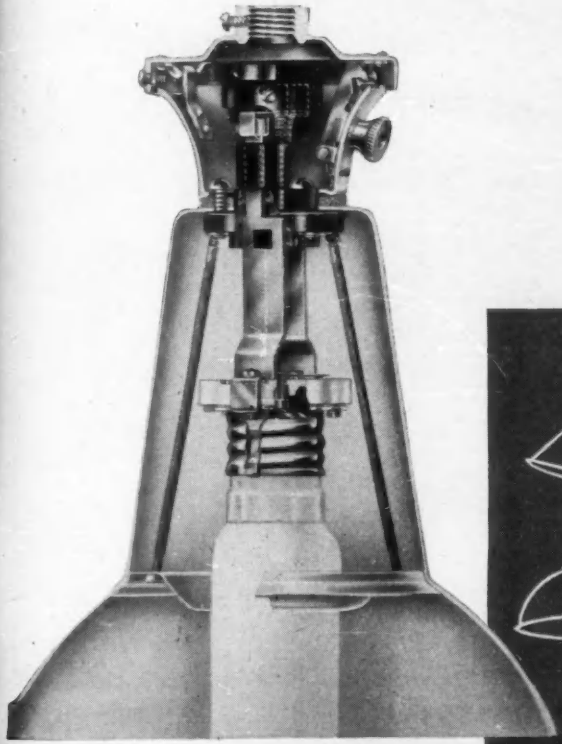


Wherever accuracy is vital—there you will find FISCHER BEARINGS

FISCHER BEARINGS COMPANY LIMITED, WOLVERHAMPTON

* By courtesy of The English Electric Company Limited

Five lampholder assemblies to cover all needs...



simplified stocking with the

MODEL FIFTY RANGE

Five assemblies to cover lighting requirements in the Tungsten Range up to 1500 watts . . . 1 BC, 1 ES and 3 GES. This development of the "SAAFLUX" Range demands the attention of stockists, contractors and users alike. Yet simplified stock-keeping is but one facet of these important modifications. Consider these points:

- **BC and ES lampholder assemblies are interchangeable up to and including 200 watts.**
- **Contact blades are now in one piece eliminating all possibility of bad contacts.**
- **One lampholder common to all reflectors for each wattage lamp.**
- **Improved 'Visor' Cover is dustproof . . . allows use outdoors and in the wet.**

'SAAFLUX' LAMPHOLDER ASSEMBLIES

Only one BC for all reflector types up to 150W.

Only one ES for all reflector types up to 200W.

Only three GES for all reflector types 300W. to 1500W.

The informative leaflet: "Model Fifty by Benjamin" will tell you all about it. Please ask for a copy.

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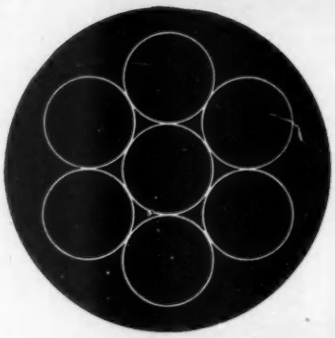
- G.E.C. lighting with Lumenated ceilings combine to provide even light distribution without glare.
- G.E.C. high efficiency control gear and Osram guaranteed fluorescent tubes are the essential components for every Lumenated ceiling.
- Before planning your next installation consult the G.E.C. Illuminating Engineering Division at your nearest branch.

G.E.C.

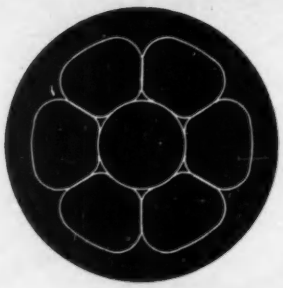
The Reality of a Complete Lighting Service

THE GENERAL ELECTRIC CO. LTD · MAGNET HOUSE · KINGSWAY · LONDON · W.C.2

STERLING insulated 'SMOOTH BODY' aluminium conductors



conventionally-stranded conductors



Sterling "Smooth Body" Aluminium Conductors

show substantial reductions in

SIZE.....8-9%

WEIGHT..10-12%

AND OF COURSE, PRICE

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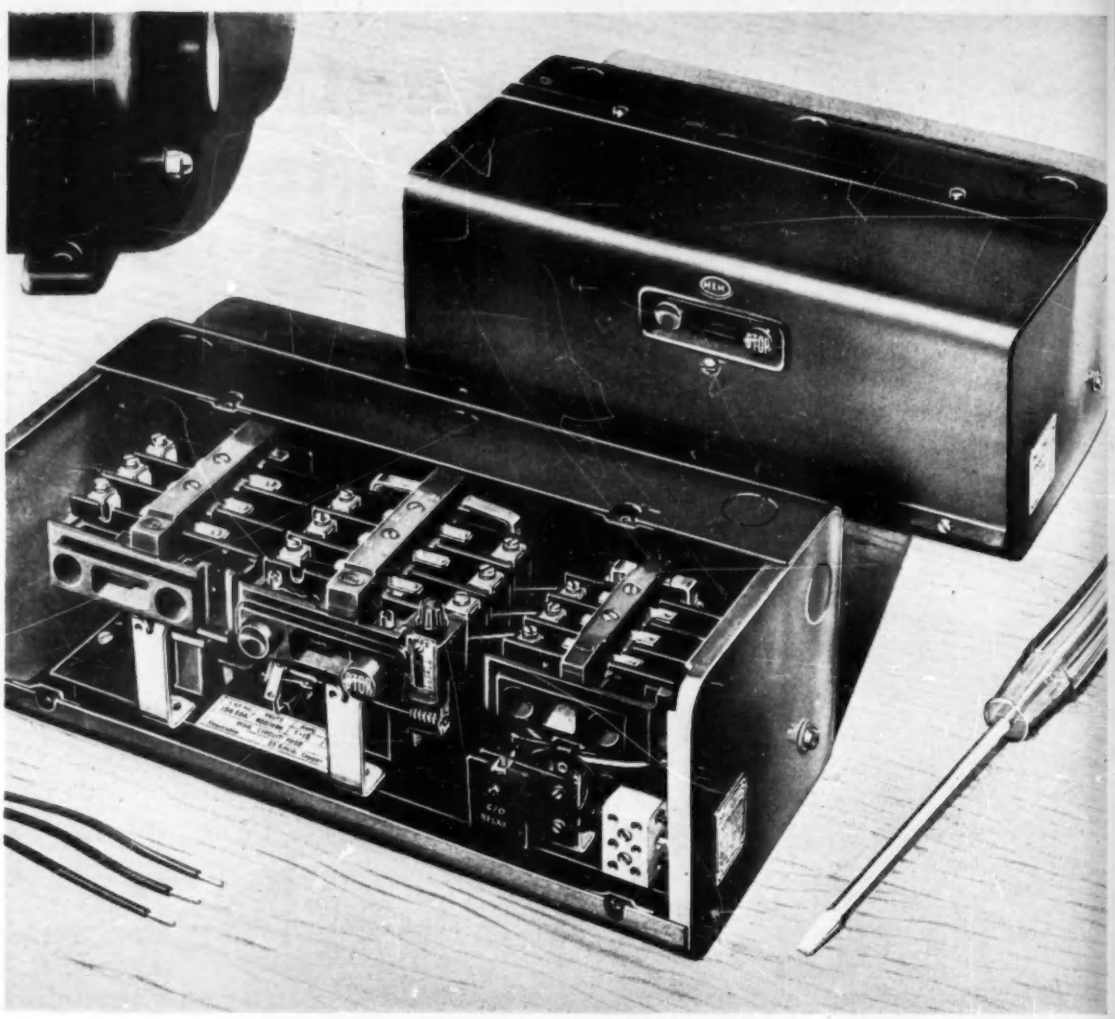


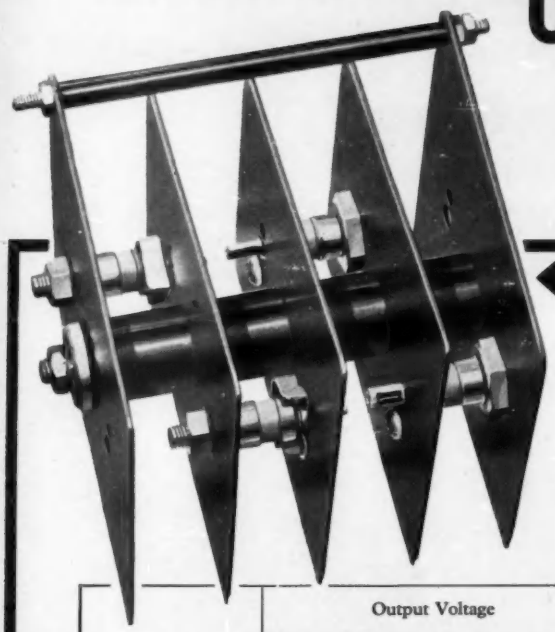
New Auto-Memota Star-Delta Starters

3 CONTACTOR PATTERN

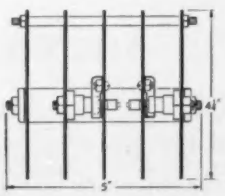
THIS RANGE OF "Auto-Memota" Push-Button Automatic Star-Delta Starters contains many new features developed in the M.E.M. Research Laboratory. The advanced design incorporates a three contactor switching circuit and an extremely reliable two-speed thermal changeover relay. Silver main contact studs are fitted throughout. All three contactors are mounted on a single sole-plate, to simplify wiring and facilitate inspection. The starter is enclosed in a light, yet strong sheet steel case of neat appearance, rustproofed, and finished stove grey enamel. Adequate knockouts are provided. Visual indication in the "Run" position. This new "Auto-Memota" Star-Delta Starter is designed for control of motors up to 10 h.p., 15 amp. rating, 200-440 volts. Send today for List No. 416.

MEM MIDLAND ELECTRIC MANUFACTURING CO. LTD · TYSELEY · BIRMINGHAM 11

The NEW SYLVANIA GERMANIUM DIODE



Full wave bridge with anodised fins. Overall size: 5" long, 4¼" high, 4" deep



BGR411 SERIES

Single phase full-wave bridge rectifier maximum storage temp. 85°C

ELECTRICAL RATINGS

	Output Voltage				Output Current, Amperes		
	GR421	GR413	GR412	GR411	25°C	45°C	65°C
Resistive Load	63	47	31	15	28	18·6	8·4
Battery or Capacitative Load	99	74	49	24	22	14·6	6·6

Tops all existing standards

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The new Sylvania series of bridges offers you the smallest size and weight per watt. Ceramic-metal seals and strongly welded closures ensure that robust Sylvania Diodes maintain efficiency in high ambient temperatures and adverse climatic conditions. They are conservatively rated, have low reverse leakage and their low capacity allows use at high power frequencies. There is a complete absence of forward ageing and unforming and they operate instantly after long periods without power. Detailed information on these Sylvania Germanium Diodes is now available. Please write for your copy.

Single diode with flexible eyelet top connection.

GR411 SERIES

BASIC DIODE RATINGS

UP TO 100v. PEAK INVERSE

HIGHER VOLTAGE UNDER DEVELOPMENT

MEAN D.C. — 14 AMPS @ 25°C; 9 AMPS @ 45°C; 4.2 AMPS @ 65°C

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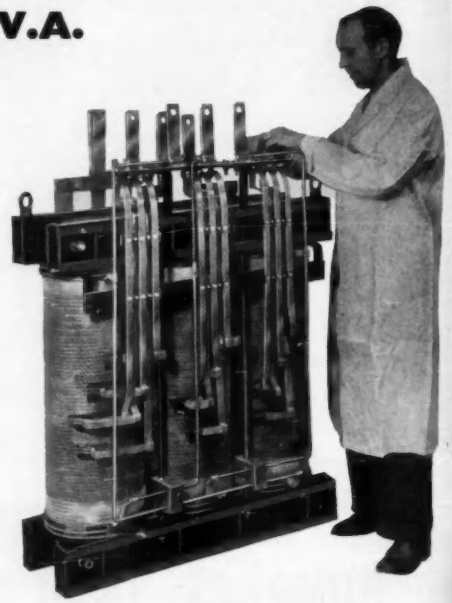

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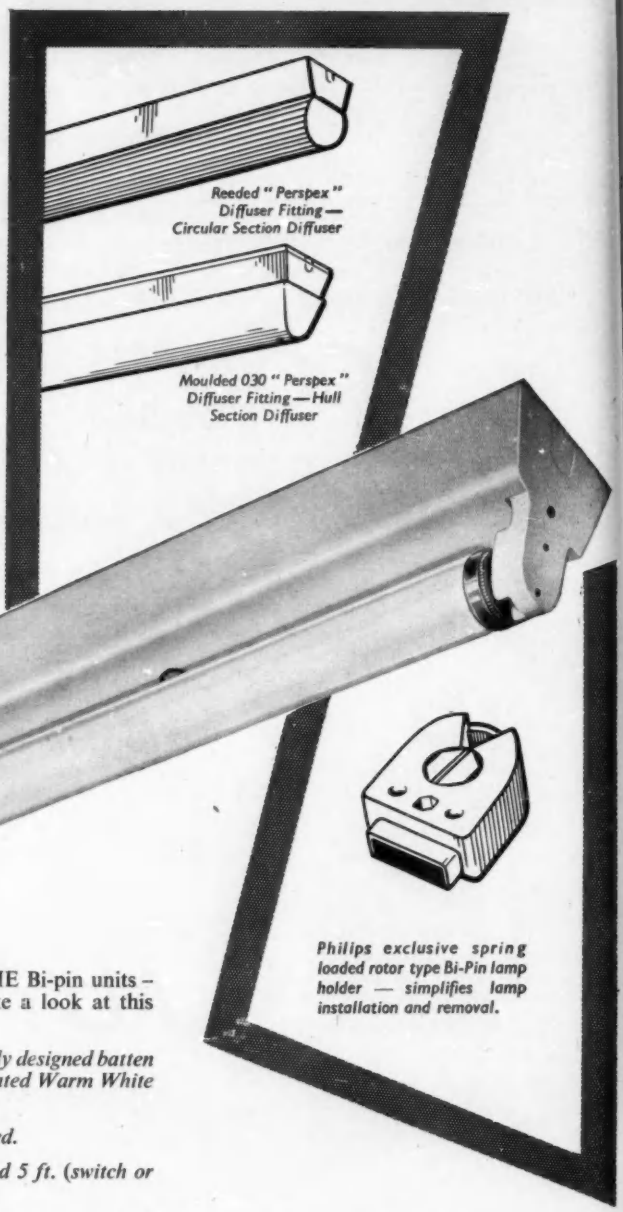
PHILIPS

series TME bi-pin units

(2ft., 4ft., and 5ft.)


Reeded "Perspex" Diffuser Fitting — Circular Section Diffuser
Moulded 030 "Perspex" Diffuser Fitting — Hull Section Diffuser
Philips exclusive spring loaded rotor type Bi-Pin lamp holder — simplifies lamp installation and removal.

This new Philips lighting development – TME Bi-pin units – gives you a wonderful sales story. Just take a look at this summary:

- *Each TME unit consists of strong, specially designed batten fitting, complete with a Philips double-coated Warm White de luxe tube.*
- *All electrical components entirely enclosed.*
- *Available in 2 ft. (switch start), 4 ft., and 5 ft. (switch or instant start) sizes.*
- *Simpler one-man fixing – and the lamp can be inserted with one hand only.*
- *Unique Philips spring-loaded rotor type Bi-pin lamp holders.*
- *Incorporates the new Philips Polyester-filled ballast – smaller, lighter in weight, silent.*
- *Two types of perspex diffusers available: reeded or moulded.*

A.1012	20w.	2′	S/S	£4.4.8	inc. P.T.
A.1000	40w.	4′	S/S	£4.11.2	,, ,,
A.1000/X	40w.	4′	I/S	£5.3.11	,, ,,
A.1004	80w.	5′	S/S	£5.3.8	,, ,,
A.1004/X	80w.	5′	I/S	£5.18.5	,, ,,

Lamps included — diffusers extra
Send for further details

Don't wait until you are asked – stock up now with the new Philips Bi-pin Lighting Units!

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LIGHTING DIVISION

Century House, Shaftesbury Avenue, London, W.C.2

(LD3119)

Rapid, high-quality photoprinting

The Ilford AZOFLEX Model 221 Combine printing and developing machine (formerly known as Model 42/63 Mark II) employs safe, odour-free AZOFLEX chemicals—just one of the many special features that make it the ideal photoprinting machine for print room or drawing office.

- Exposing, developing and drying operations completely synchronized.
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- High continuous output easily maintained by one operator.
- Excellent copies obtainable from old or faded originals.
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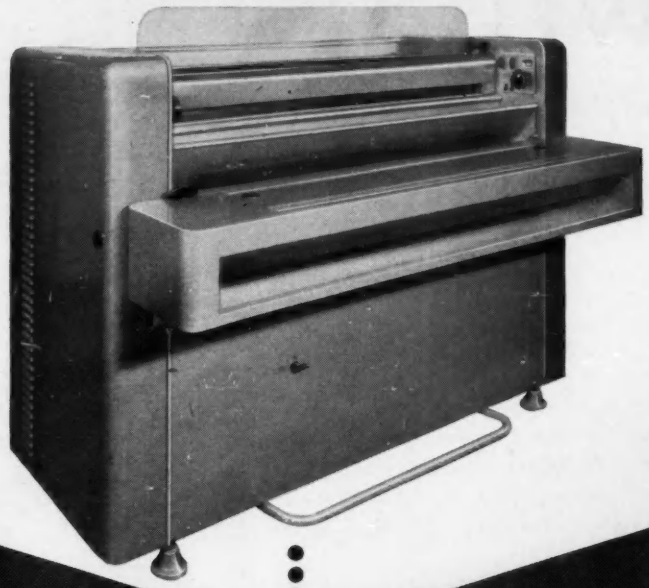

and no unpleasant fumes

Capacity: rolls and cut sheets up to 42 in. wide. Printing speed: 6 in. to 15½ ft. per minute. Lamp: H.P.M.V. MA/U 2,000 watt. Dimensions: height 50in., width 67in., depth (tray extended) 52in. Weight: 850 lb.

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ILFORD *Azoflex*

PHOTOPRINTING MACHINES & MATERIALS

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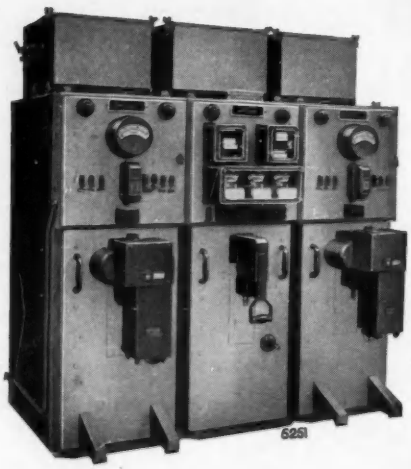

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HORIZONTAL DRAWOUT

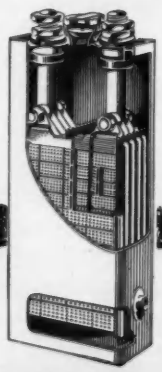
LONG & CRAWFORD LTD.

GORTON ROAD - MANCHESTER 12

WHAT'S NEW ABOUT NIFE SWITCH TRIPPING UNITS?

The design is, for a start. The fascia panel, with its flush-fitting rectangular meters, is particularly clean and uncluttered. The inclusion of a high-rate charge indicating light is without precedent. Inspection of batteries has been simplified by putting them in *one* tier. The useful space at the bottom of the cabinet is just the place for tools. Finally, the cost is new. No, it isn't more but *less* than that of the former model. Now—

What's old about Nife Switch Tripping Units? Their reliability! Like the previous 12,500 models which are in service throughout the world, these new units are steelclad, self-contained and powered by the Nife steel battery. The battery that's free from self-discharge; the battery that won't corrode. The battery, in short, that *never* lets you down.



The Nife Switch Tripping Unit can be used, in addition, for any other application involving intermittent discharges. You'd like to know more about it?

Write for Publication No. 2751/A

NIFE BATTERIES · REDDITCH · WORCESTERSHIRE

N127

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Suppliers of Fire Extinguishers The Pyrene Company Limited

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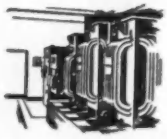

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Write for full details or instruct us to send a Technical Representative to give you expert advice without charge or obligation.

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In accordance with Specifications BS/1117 : 1955 and 115 : 1954.

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Possessing Thermal-EMF values in accordance with BSS. 1827 : 1952
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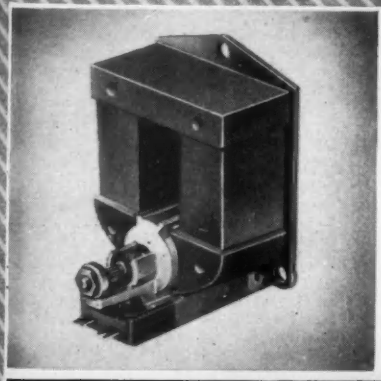

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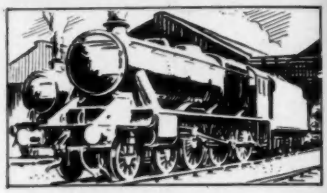
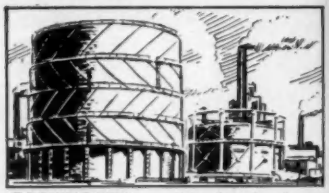


LOCOMOTIVE SHEDS "installed over a railway turntable . . . not been attacked in any way by the corrosive fumes . . . interior of the reflectors perfectly clean."

STEEL WORKS "Reflectortight fitted in Sulphate House — no noticeable corrosion, reflector found to be in perfect condition."



GAS WORKS . . . "used under heavy fine coke dust conditions, the temperature is 180°F continuous and intermittent . . . Reflectortight giving good service."

ELECTRO PLATING WORKS "We would say that in our opinion it is a fitting ideally suitable for the corrosive atmosphere of a Plating Shop."

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"REFLECTORTIGHT"

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Deck cranes

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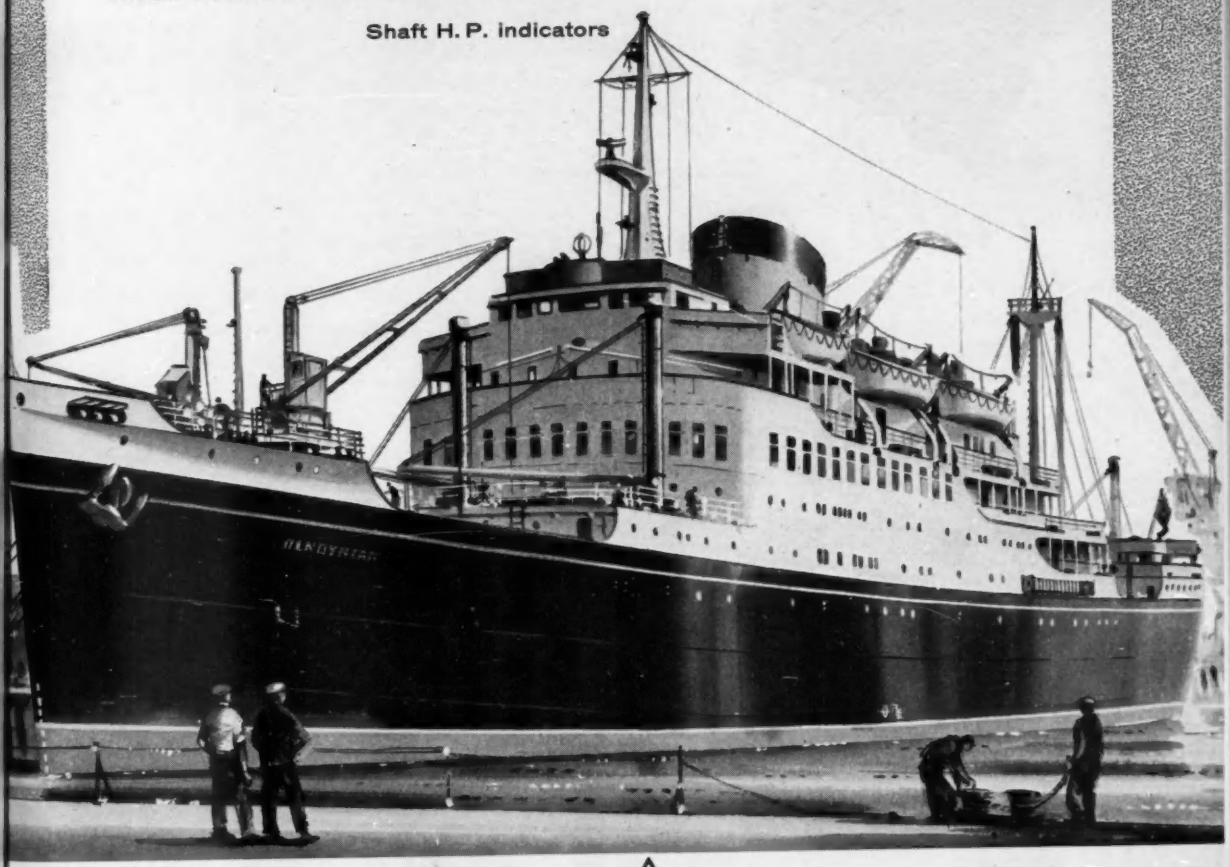

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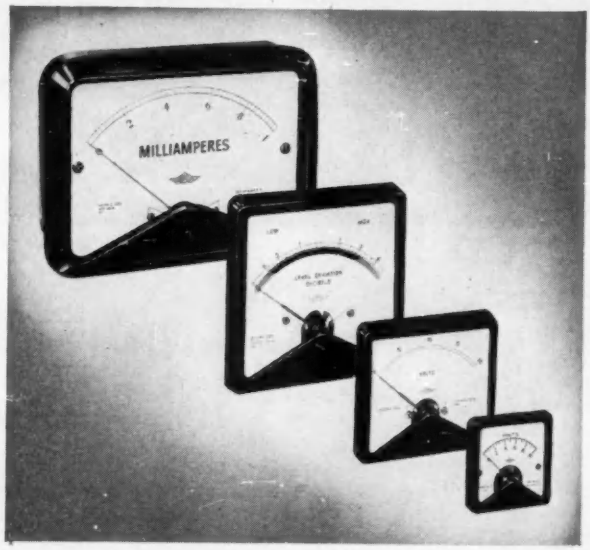

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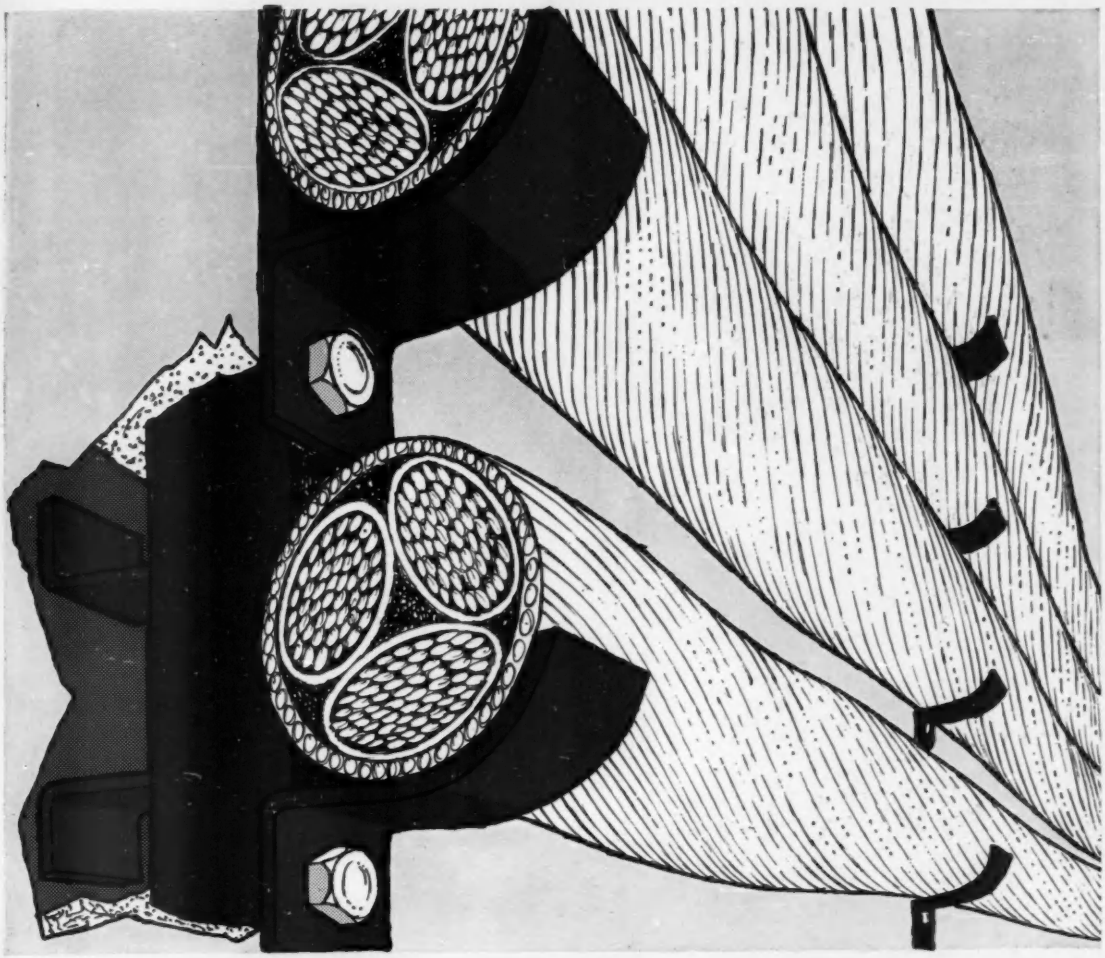
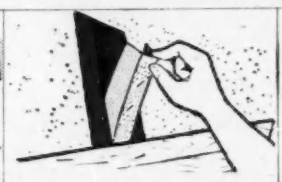


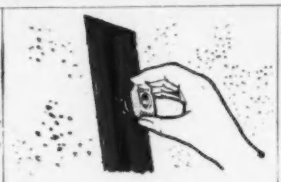
STEADY AS A ROCK —ADJUSTABLE AT WILL

Unistrut concrete inserts permit rapid completion of heavy piping and electrical installations. Large savings are evident both at the planning stage and in actual on-site costs. Easy access for maintenance, or for additions to the installation, provides further economies in service. Please write for illustrated details.

t concrete insert lightly fixed ttering. When concrete is he special anchors at the back nnel make it an integral part cture.



Unistrut fittings can be attached as soon as the shuttering is struck. Card-board closer strip, protecting inside of channel from stray concrete, is easily removed.



Inserting self-locating Unistrut nuts by which fittings are quickly and securely attached at *any* point of the insert.

Section through a complete assembly shows its box-section strength. Serrated grooves in the nut grip the channel edges firmly.

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Unistrut concrete inserts another feature of the Unistrut Steel Channel Framing System —for piping, racking, electrical installation and all framing applications.

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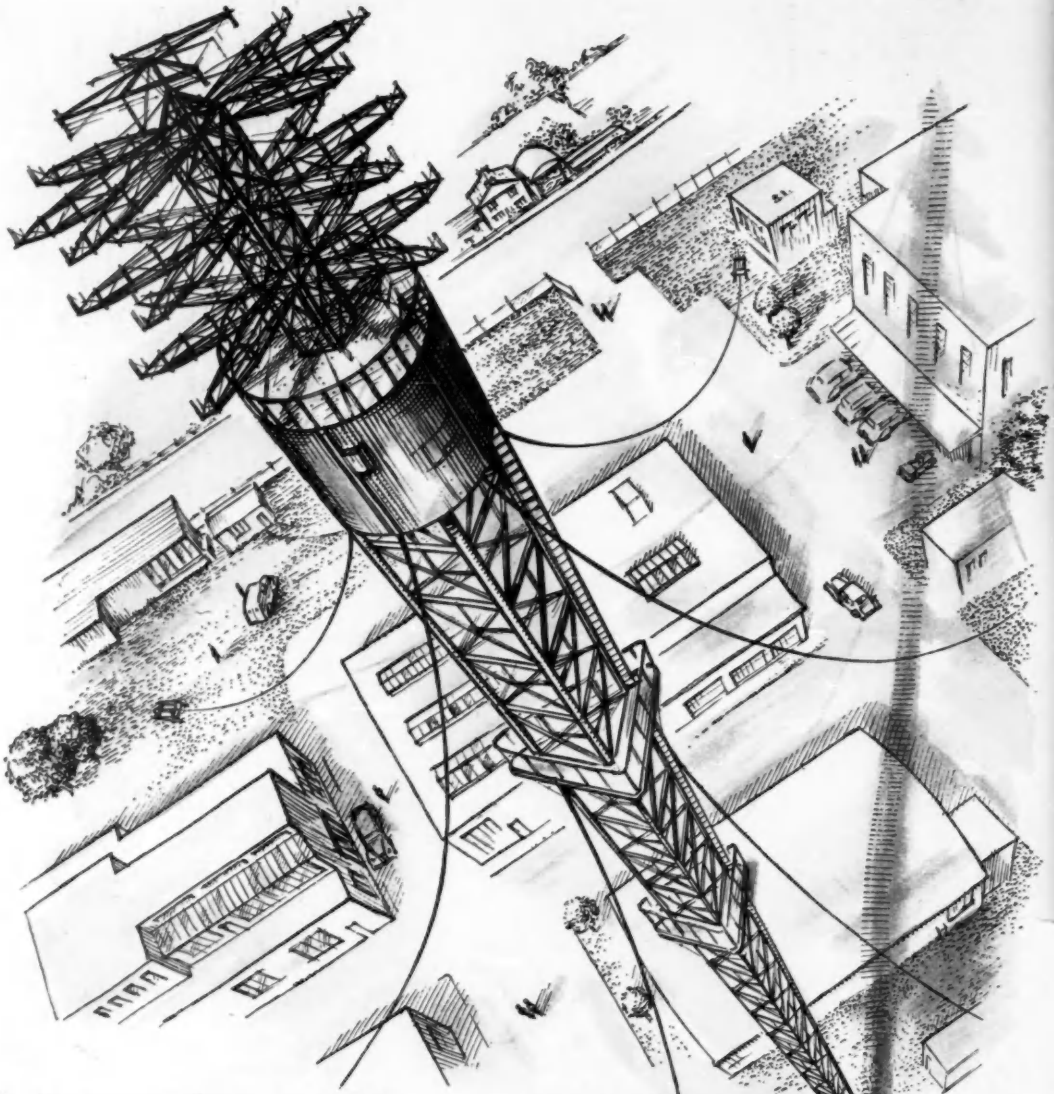

Taking things for granted

Television Masts, whether we like it or not, are accepted as part of the landscape. Television screens throughout the country rely on them for signals. Not so conspicuous, but nevertheless playing their part, Rist's Cables are another of the many things taken for granted.

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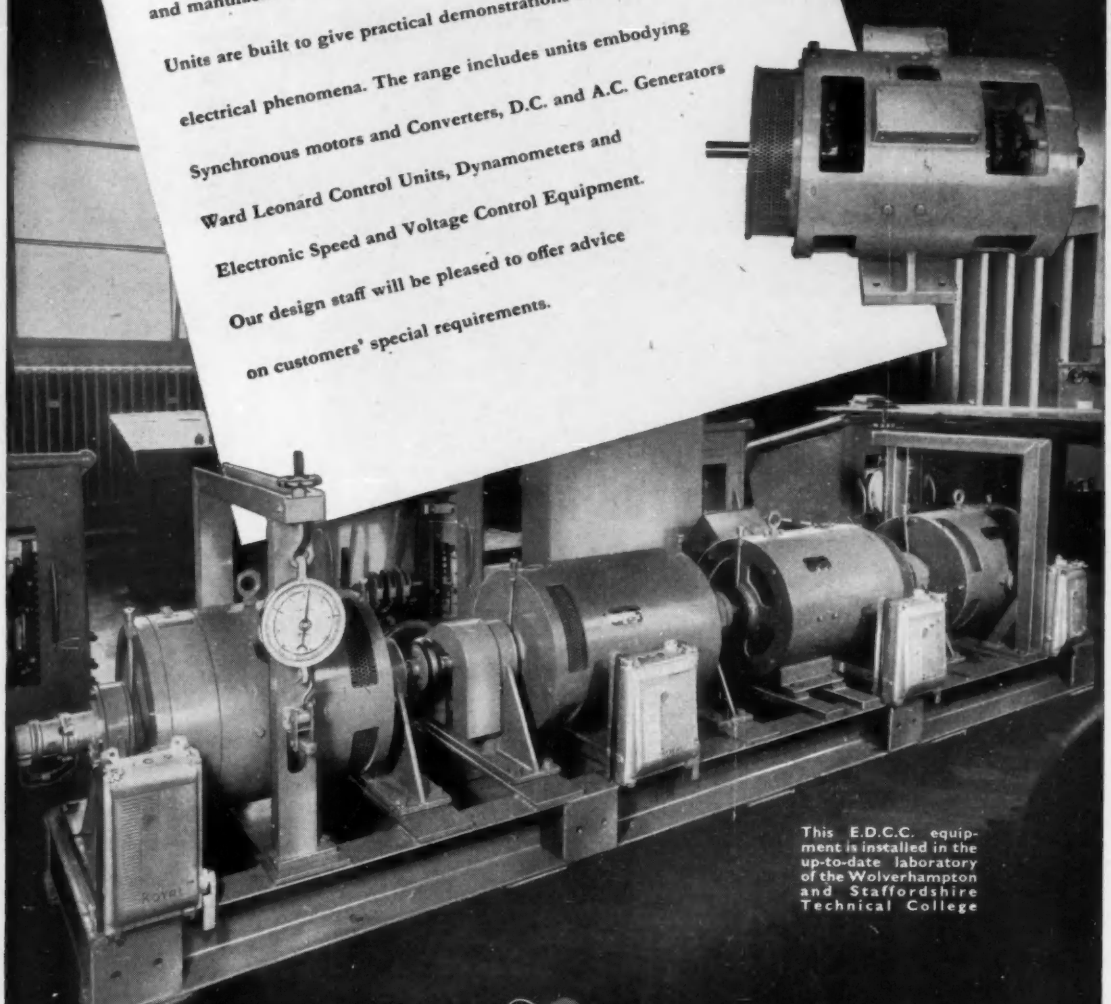

This E.D.C.C. equipment is installed in the up-to-date laboratory of the Wolverhampton and Staffordshire Technical College

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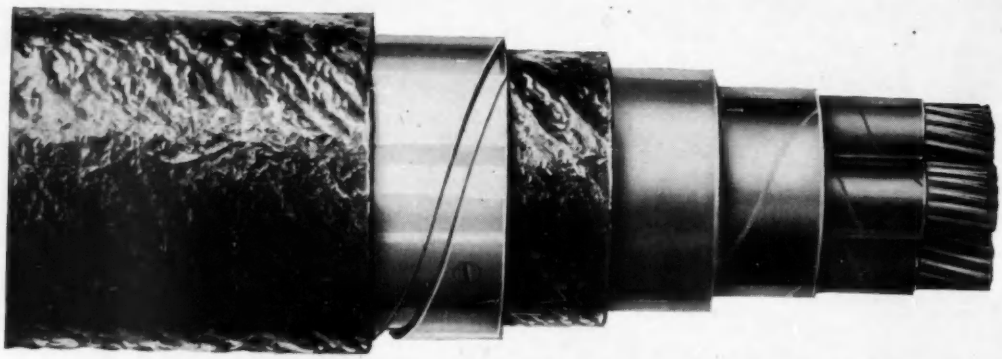

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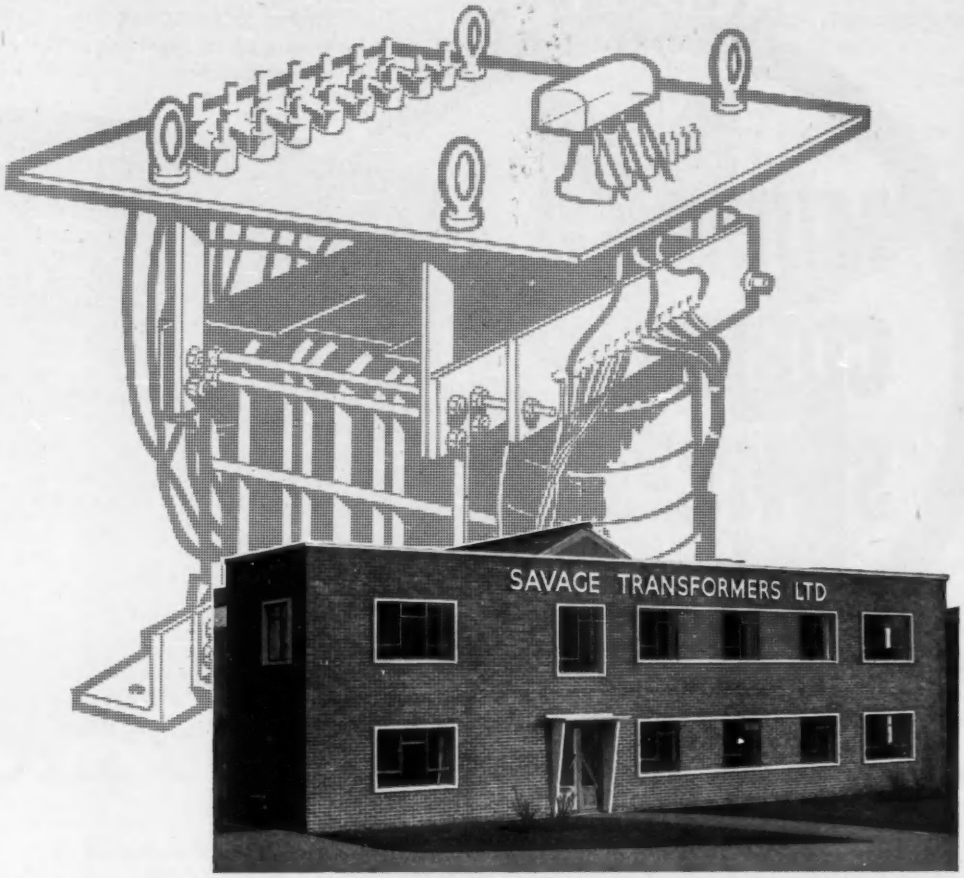

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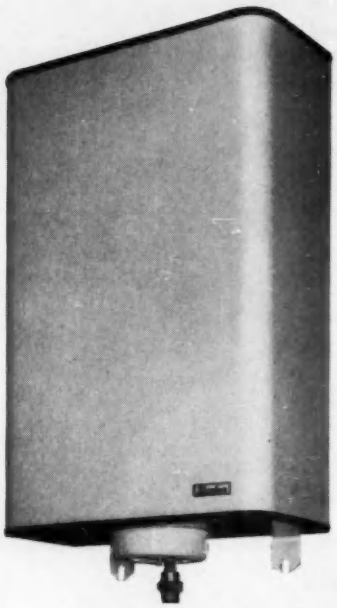

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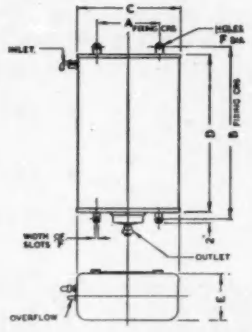
CAPACITIES		5	7½	12	15	20 gall.
STANDARD LOADINGS	210 V	920 W	920 W	1530 W	1530 W	1530 W
	240 V	1200 W	1200 W	2000 W	2000 W	2000 W

WALL MOUNTING RECTANGULAR D.F.

CAPACITY	A	B	C	D	E	F
5 Gall.	12¼"	33⅜"	19¼"	30½"	9"	½"
7½ Gall.	14"	34⅜"	21⅛"	31½"	10"	½"
12 Gall.	16"	37⅜"	23¼"	34½"	11⅜"	⅝"
15 Gall.	16"	37⅜"	25¼"	35½"	14⅜"	⅝"
20 Gall.	20"	37¼"	28¼"	35½"	15⅜"	⅝"

INLET ¾" B.S.P.T. OUTLET ¾" B.S.P.T.



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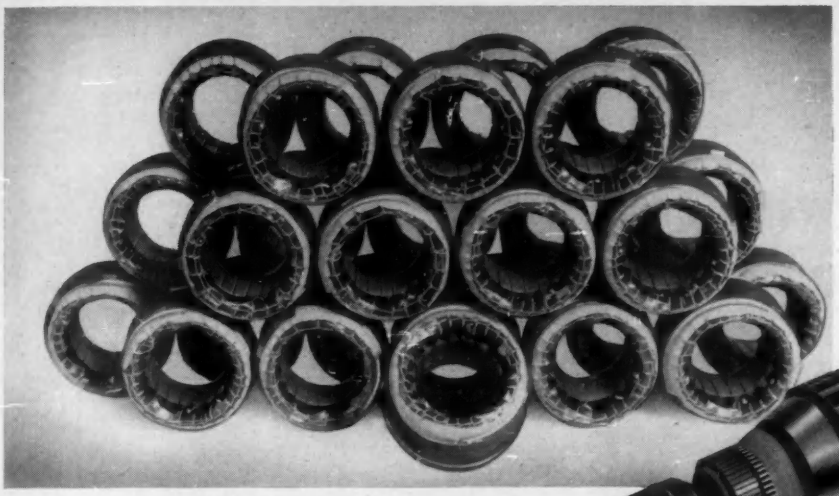

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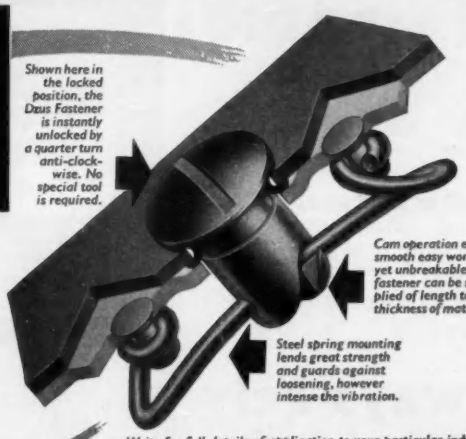
Shown here in the locked position, the Dzus Fastener is instantly unlocked by a quarter turn anti-clockwise. No special tool is required.
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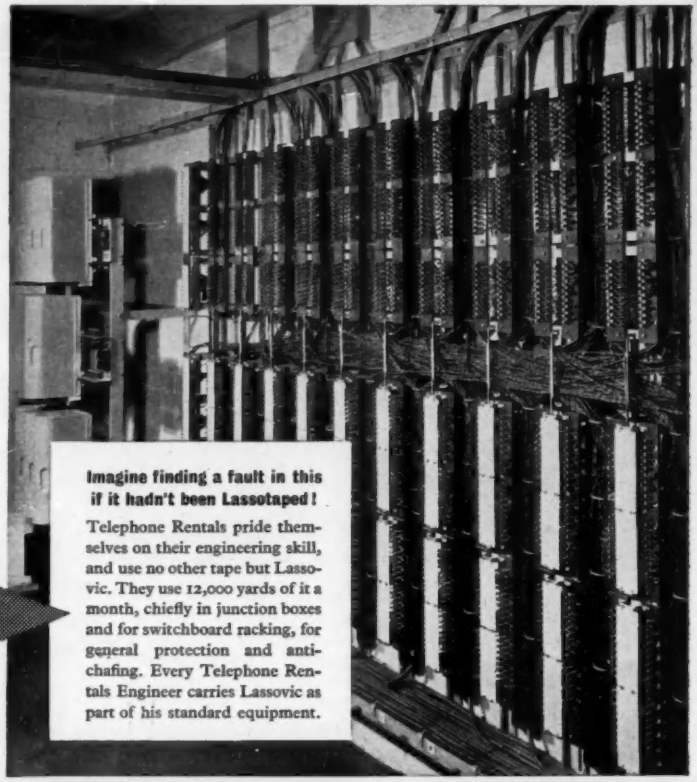

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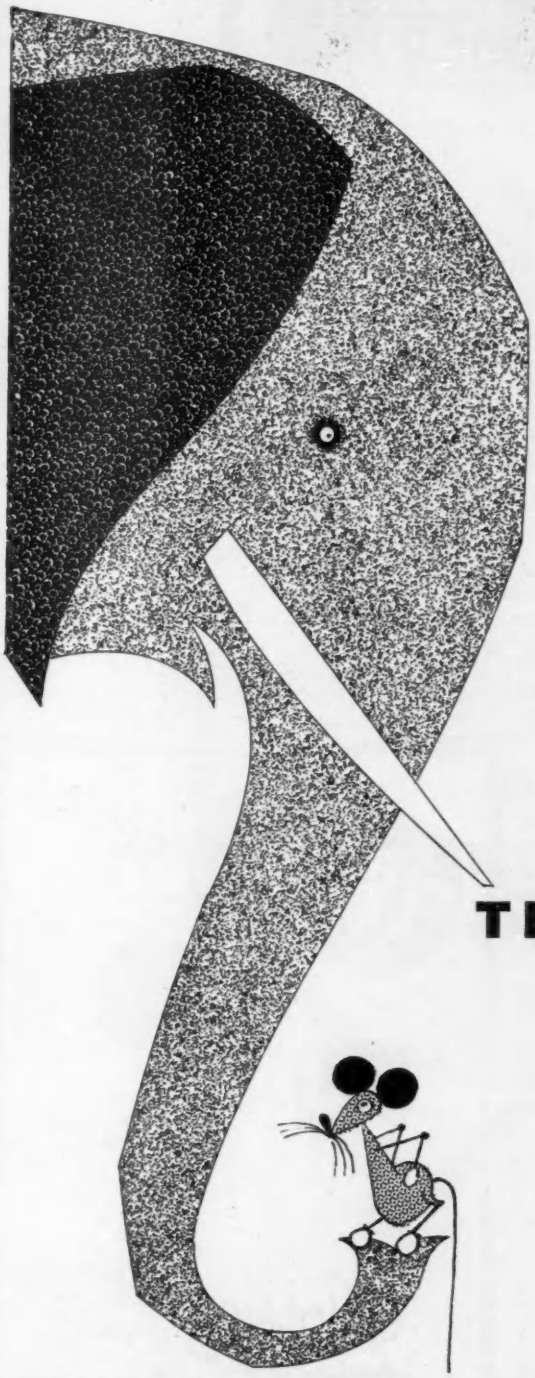

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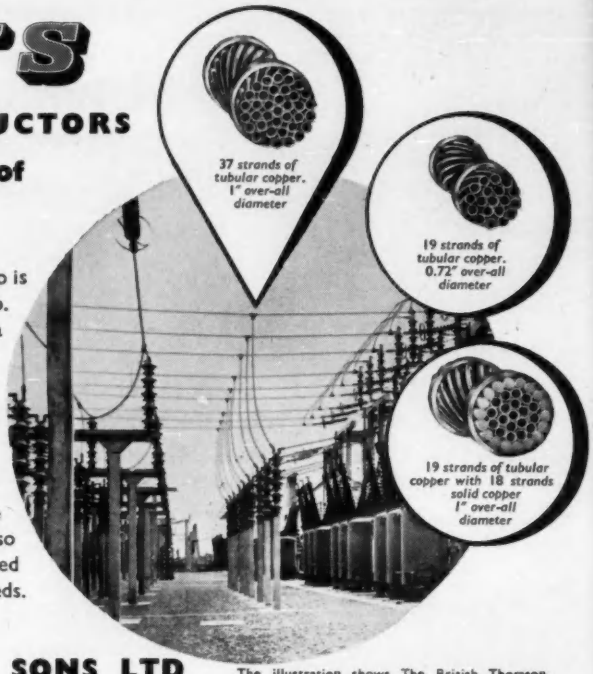
37 strands of tubular copper. 1" over-all diameter
19 strands of tubular copper. 0.72" over-all diameter
19 strands of tubular copper with 18 strands solid copper 1" over-all diameter

The illustration shows The British Thomson-Houston Co. Ltd. 132-kV, 3,500 MVA switchgear at Castle Donington Power Station of the C.E.A. (East Midlands) incorporating the 37-strand tubular conductor.
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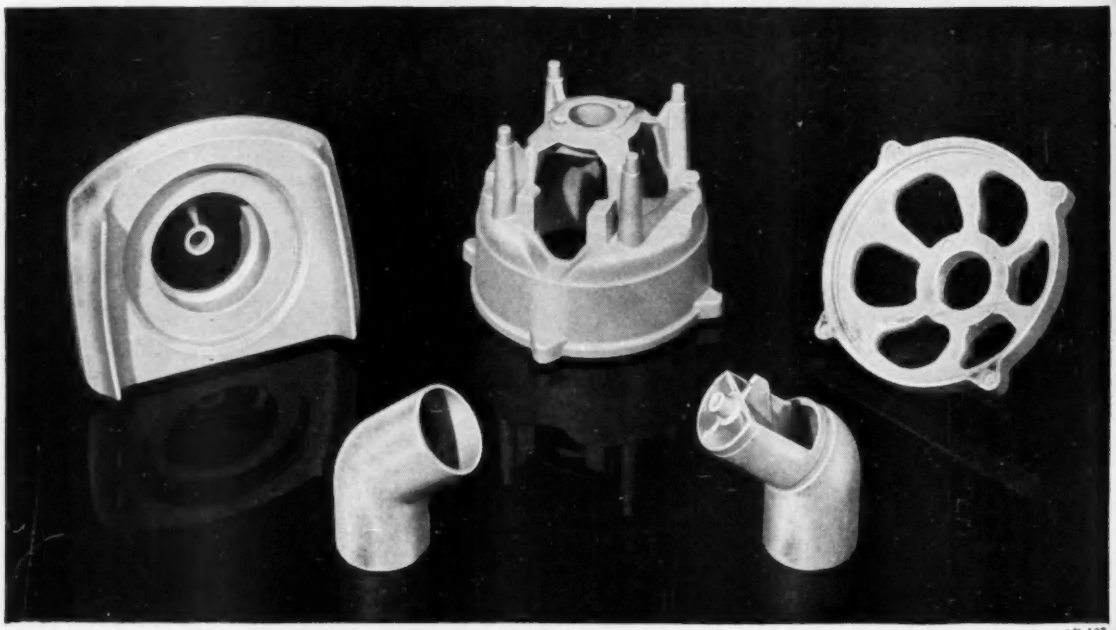

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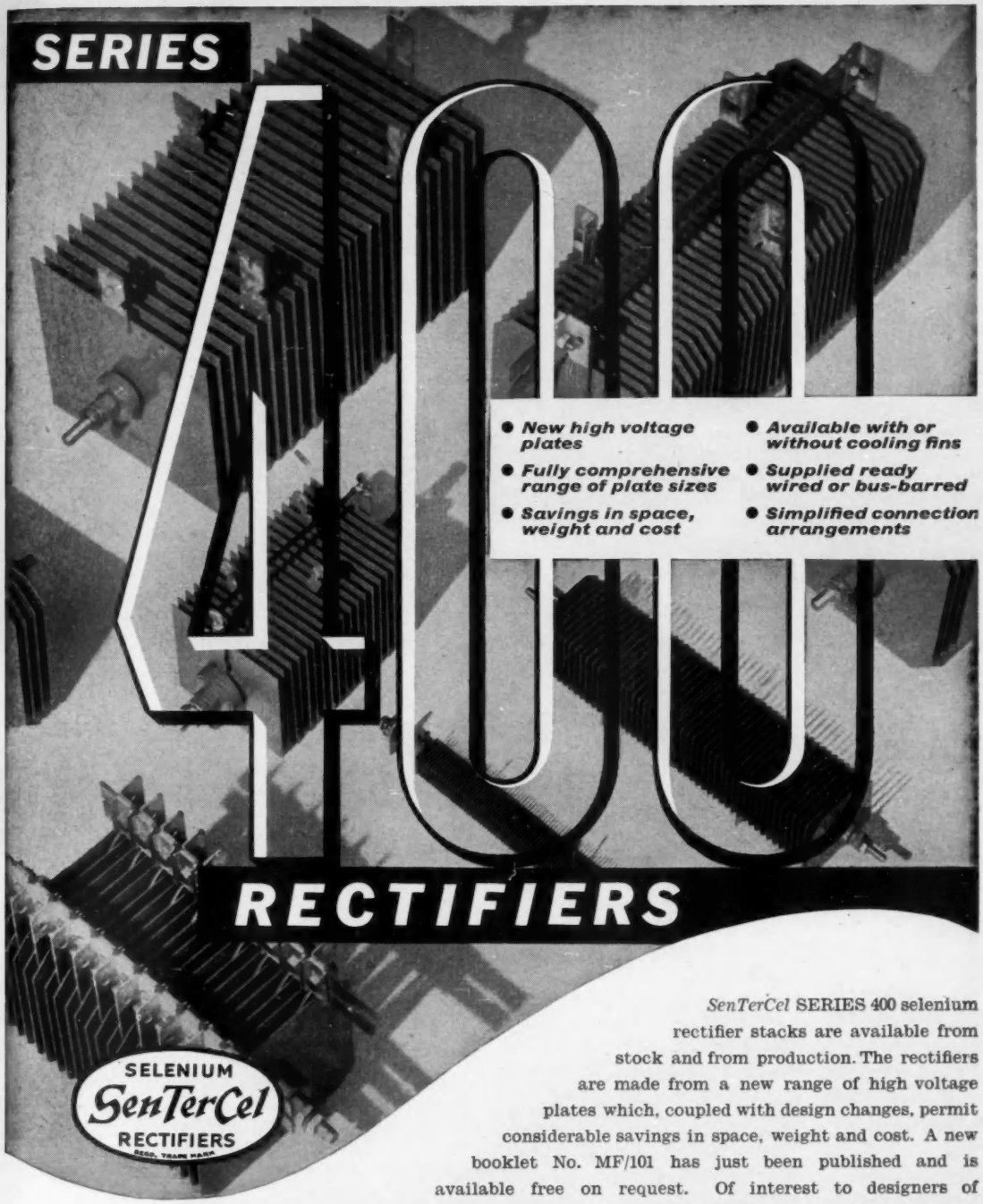

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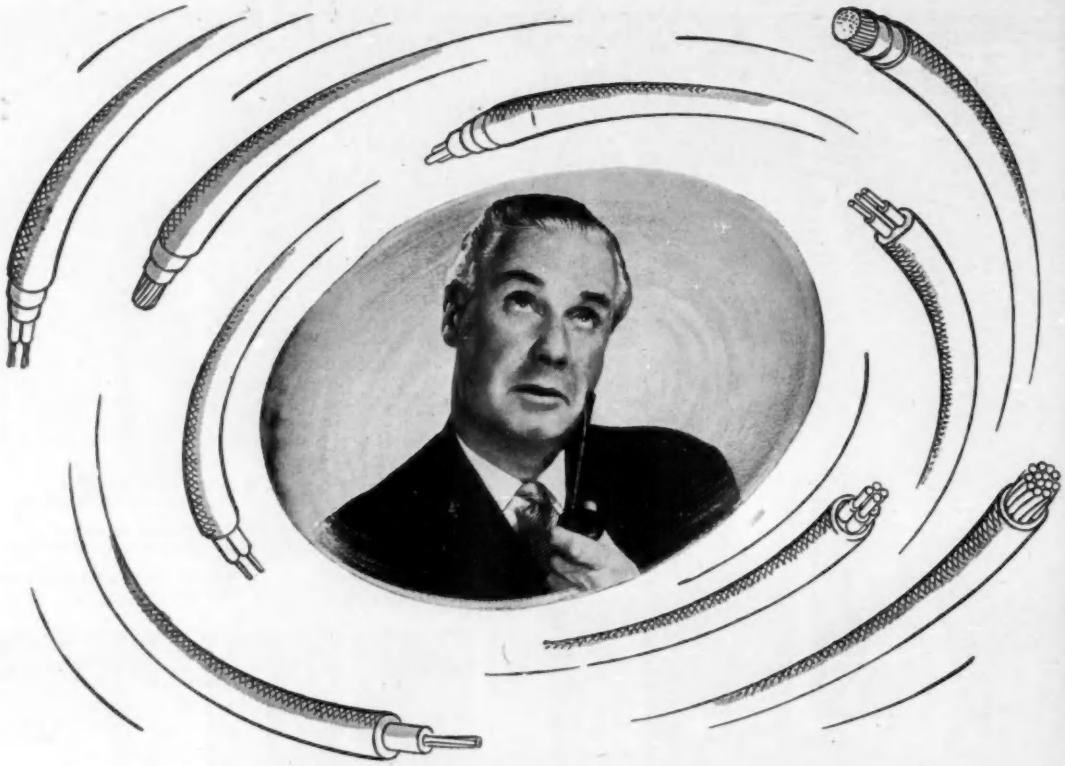

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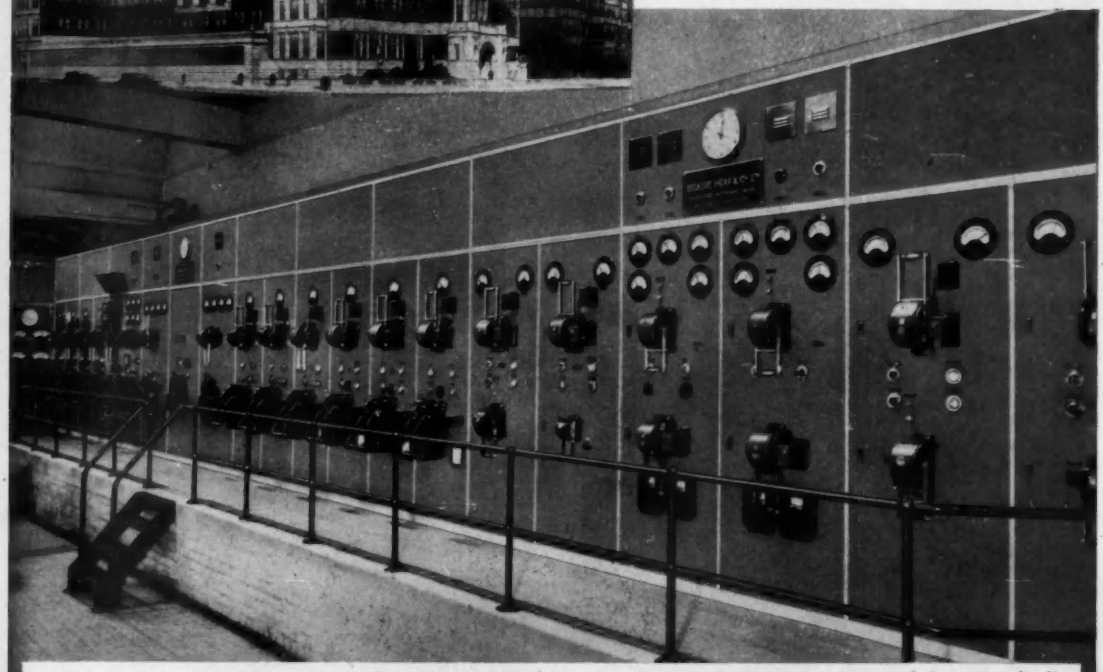
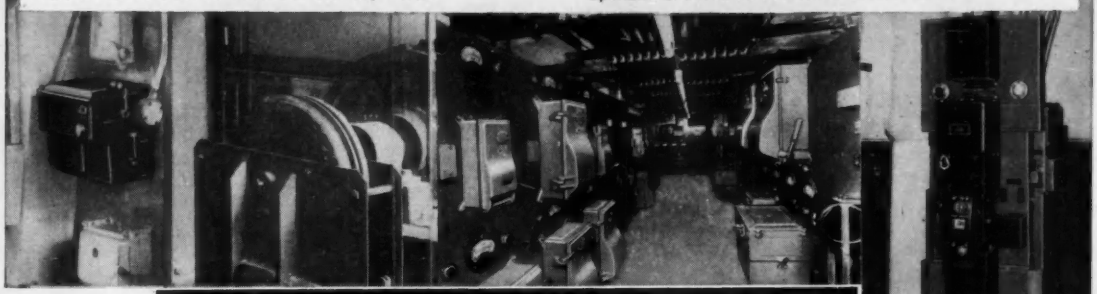
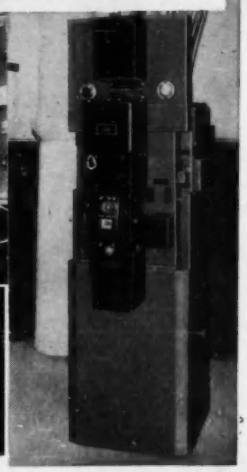


The illustration above shows the main switchboard for controlling the power and lighting to both the original College and the New Extensions. The switches are of 25 MVA rupturing capacity, tested to BS.116 at 400 volts. Duplicate bus bars are provided with front-of-board operated changeover switches for changing over between the College's own Turbo Alternator Set and the Electricity Board.

Bottom left hand illustration is one of the many circuit breakers for controlling the lift installations.
The centre illustration below shows a few of the twelve distribution boards throughout the building.
The bottom right hand illustration shows one of the solenoid operated 25 MVA ironclad circuit breaker units.





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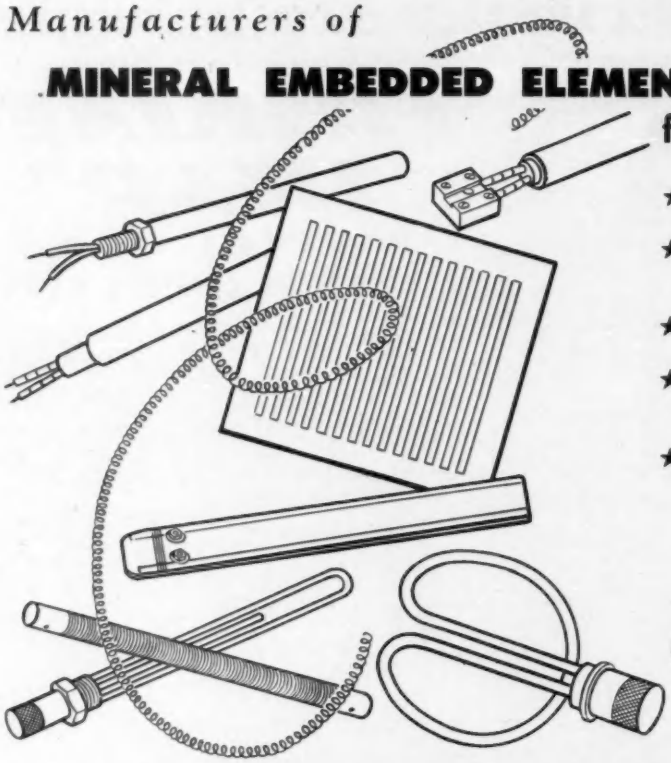

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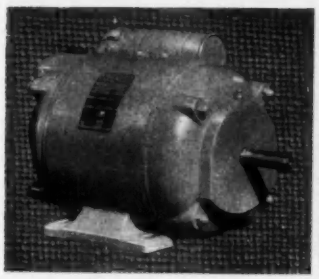

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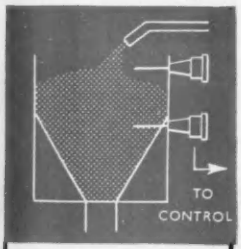
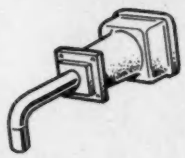
T.L.C.1 Control Unit and Probe Head with Normal Duty Probe, showing the simple rugged compact construction of the cast alloy weather-proof case

T.L.C.2 Multi-Level Controller, showing interior construction of remote control unit



High and low level control of fertilizer in hopper. Control unit mounted remotely on central control panel



High level indication of flour in hoppers using angle probe

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Equipment range integrated by common probe head unit for all electrode assemblies for a comprehensive range of applications.

How it operates:

External capacitance represented by probe and earth is connected to the tuned circuit of the oscillator. The oscillator, and the relay in the control unit is energised when the probe is clear of material for high level, and when immersed for low level control. The control relay is operated by a transistor circuit which detects the changed conditions in the oscillator as a result of the capacitance changes at the probe on the approach or recession of the material.
The equipment is designed for operation on 200/250 volts or 110 volts, 50/60 c.p.s. single phase supplies, and imposes a load of 30vA approximately.

Some materials controlled by the T.L.C.

BEER, BRINE, BONEMEAL, CEMENT, CEREALS, CHALK, CHEMICALS, CHOCOLATE CLAY COAL, COKE, FERTILIZER FLOUR, FLUE-DUST, FRUIT JUICES, GLUCOSE, GRAVEL, LIME, MILK, OILS, PEAT PLASTIC GRANULES, RUBBER, SAND, SALT, SUGAR, WOOD CHIPS.

How it is applied:

Illustrated are typical applications of the T.L.C.1 & 2 level controllers with examples of the many probe types available.

Your request for further information will be dealt with promptly

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ELECTRONIC BEP EQUIPMENT

RUGELEY, STAFFORDSHIRE, ENGLAND

Manufacturers of Britain's widest range of industrial electronic equipment

A member of the Lancashire Dynamo Group

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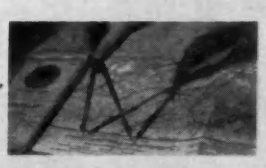

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INSULATED WIRE

Manufactured at the Port Tennant works of the Aluminium Wire & Cable Co. Ltd., AWCO E P ANODAL INSULATED WIRE is electrical purity aluminium wire with an integral insulating film produced by a special process of anodic oxidation. It possesses unique properties that distinguish it from other insulated wires. They include:—

1. **high thermal stability of the insulation,**
2. **excellent heat transfer characteristics,**
3. **appreciable reduction in weight for coils maintaining the electrical characteristics of a copper winding, and**
4. **smaller space occupied by the insulating film.**

By taking advantage of these unique properties of ANODAL insulated wire you can effect considerable savings in wire costs for many applications.

ANODAL insulated wire is at present supplied in sizes within the 16-36 swg range.

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* ANODAL *is a registered trade mark*

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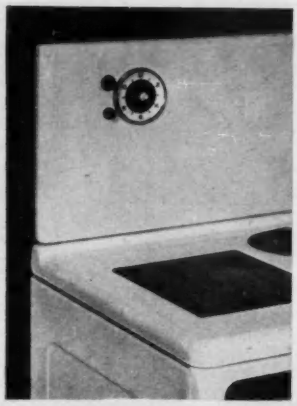
AP 66

TIME CAN WORK FOR YOU!



Everyone likes to use their time to the best advantage. The new Carron Auto-Timer model enables the busiest housewife to plan her day ahead. The Auto-Timer is very easily operated.

The Carron 'L.75' Electric Cooker is the wise choice of customers who value good appearance combined with sturdy construction. It is an attractive asset to any kitchen and gives dependable service at all times.

Time will work for you too! Stock this new cooker in your showrooms and use time to your benefit.

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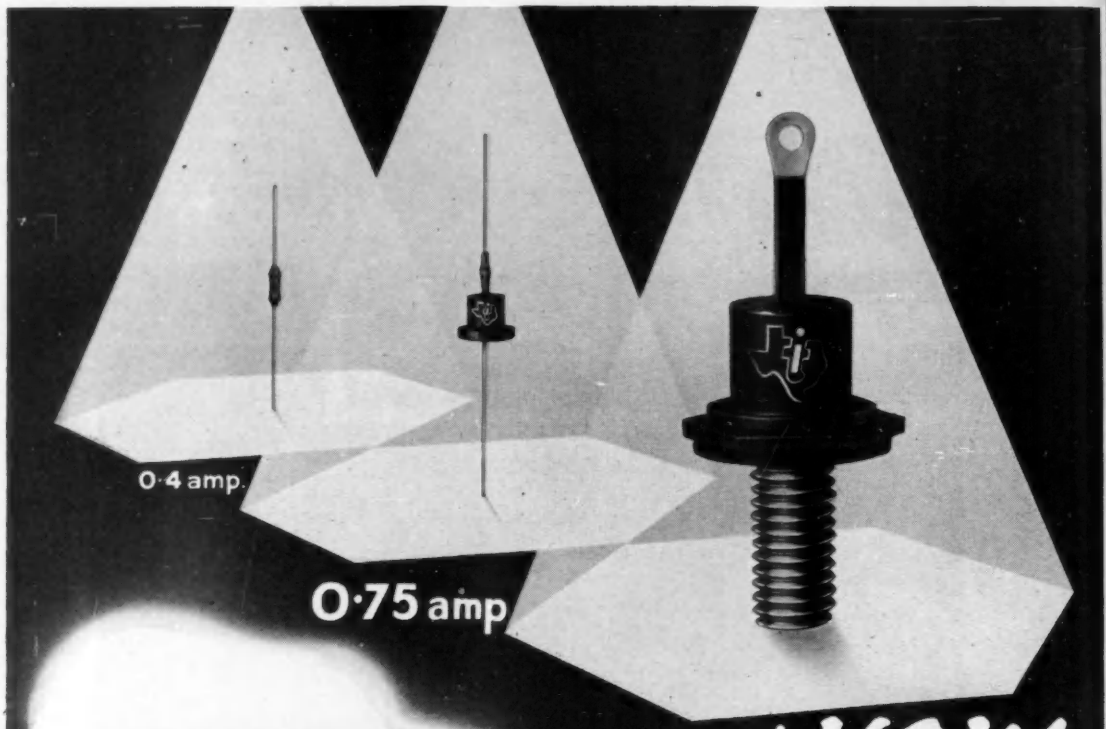

SILICON RECTIFIERS

200-600 volt P.I.V.

and NOW 3·0 amp.

This new Texas diffused junction silicon rectifier gives you full 3-ampere output at 50°C. with P.I.V. ratings up to 600 volts. The all-welded rugged construction with glass to metal seal, provides high resistance to shock and vibration.

Anode-to-stud units denoted by "R" suffix to type number.

MAXIMUM RATINGS — U.K. Nos. / U.S.A. Nos.	1S401 1N1124	1S402 1N1125	1S403 1N1126	1S404 1N1127	1S405 1N1128	unit
Peak Inverse Voltage at —65°C to +150°C	200	300	400	500	600	V
*Average Rectified Forward Current at +50°C	3	3	3	3	3	Amp
*Average Rectified Forward Current at +150°C	1	1	1	1	1	Amp
*Recurrent Peak Forward Current at +50°C	10	10	10	10	10	Amp
Surge Current, for 5 milliseconds at +25°C	25	25	25	25	25	Amp
Operating Temperature, Ambient	—65 +150					°C
SPECIFICATIONS						
Max. Full Cycle Avg. Reverse Current at +150°C	0.3	0.3	0.3	0.3	0.3	mA
Max. Reverse Current at PIV at +25°C	10	10	10	10	10	μA
Max. Forward Voltage Drop at I_b = 1 Amp at +25°C	1.1	1.1	1.1	1.1	1.1	V

* Rectifier mounted on 2" × 2" Heat Sink, 1/16" aluminium.

Actual Size

Full information on all Texas Rectifiers available on request.

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Pioneers of Semiconductors

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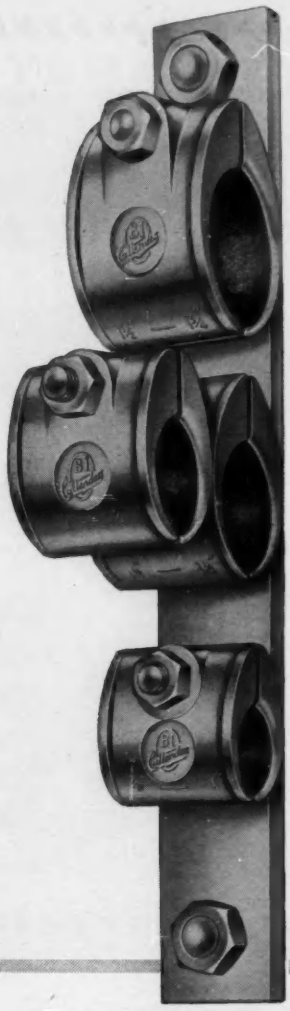
fix them FIRM and FAST!



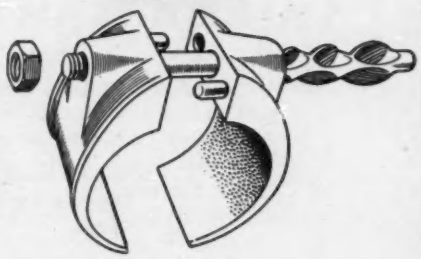
Here's why Claw-type Cleats can speed up your cable installations :—

They are light and strong, compact and space saving.

Simple to fix to walls or steelwork, vertically or horizontally.

Easily accessible on multi-cable runs for making extensions or adaptations.

Further information is given in Publication No. 287 — available on request.



Claw-type Cleats can be used singly or in groups mounted on galvanised steel backstraps.

BICC

claw type CABLE CLEATS

BRITISH INSULATED CALLENDER'S CABLES LIMITED 21 Bloomsbury Street London W.C.1

Lilliputian and Brobdingnagian

Gulliver would have been quite at home on our Stand at the Electrical Engineers Exhibition surrounded by pygmies and giants of the insulator world.

The photograph re-produced above illustrates the vast range of porcelain insulators manufactured by Taylor Tunnicliff & Co. Ltd.; the smallest shown measures ½" x ½" dia. and the largest 12 ft. x 2 ft. dia. From the smallest to the largest they are all backed by the skill and knowledge of ninety years manufacturing experience.

TAYLOR TUNNICLIFF & CO. LTD.

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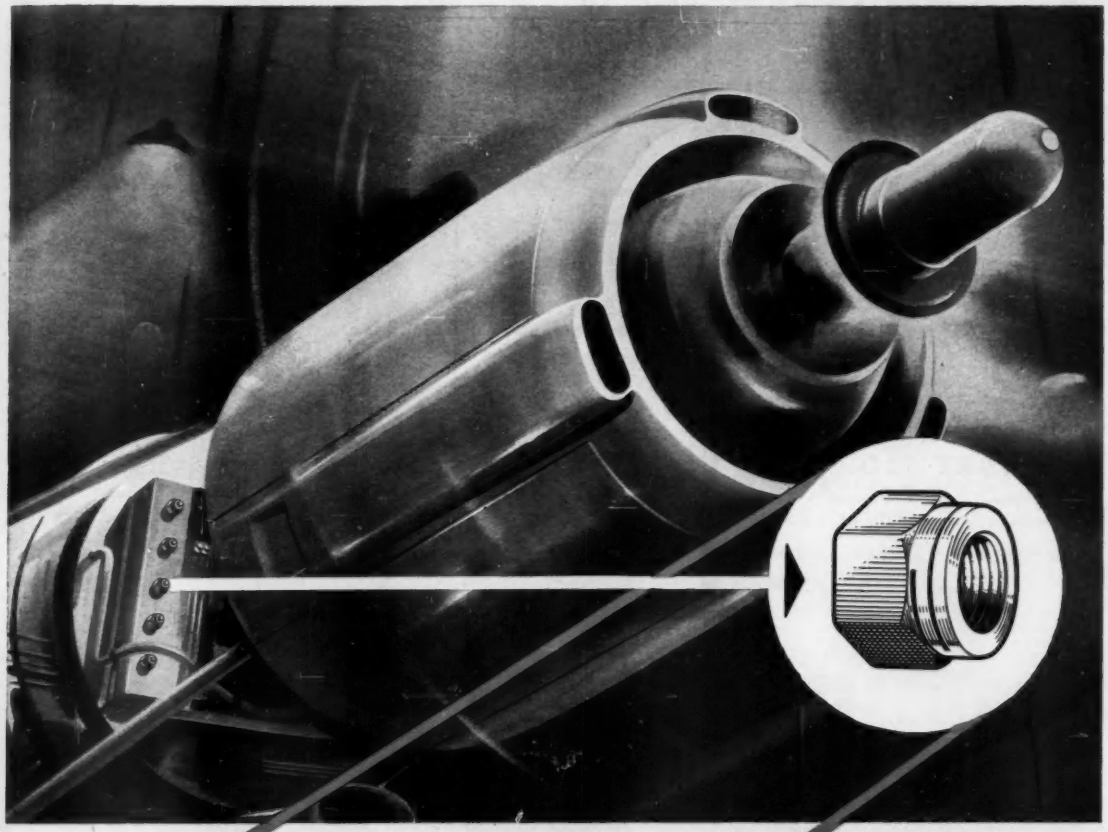
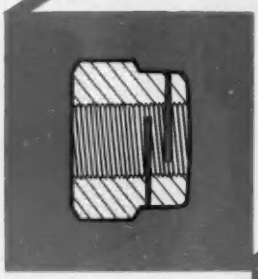


YOU CAN SAY THAT AGAIN!



Fantastic tenacity! That's the reaction of Philidas Self-locking nuts to every degree of vibration . . . heat change . . . oil infiltration or constant use. Their amazing steadfastness is due to an ingenious opposing torque cross-cuts feature which sets up a tension that only a spanner can release. The range of Philidas Self-locking nuts includes standard and thin industrial and turret nuts, capped nuts, single and double anchor nuts

THEY YIELD ONLY TO A SPANNER

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WHITEHOUSE INDUSTRIES LTD
Ferrybridge, Knottingley, Yorks.
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SELF LOCKING NUTS

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Flawless

No, we shall not be silly and claim that our castings are as flawless as a piece of 16th century Venetian Glass. But we can go this far: we can say that just as the old master craftsmen got great satisfaction out of doing a job as well as it could possibly be done, so do we. That is why so many customers whose castings must have a fine skin which will readily anodise put their trust in Great Bridge Foundries

PRECISION CASTINGS IN ALUMINIUM, GUN METAL, GREY IRON, ETC. TO ALL SPECIFICATIONS

Phos. bronze and gun metal solid and cored sticks always in stock

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WRIGHT

'ELECTROSUDS' Pumps

IMMERSED TYPE

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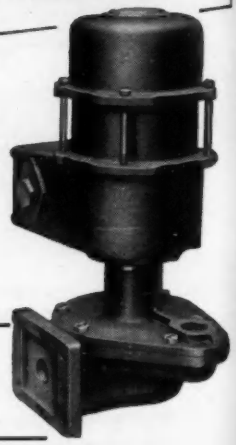


A wide selection of types in four sizes

"MINIM" 3 GALLONS PER MINUTE AT 6ft. HEAD.
"MINIMORE" 6 GALLONS PER MINUTE AT 6ft. HEAD.
"MINOR" 8 GALLONS PER MINUTE AT 10ft. HEAD.
"MAJOR" 25 GALLONS PER MINUTE AT 12ft. HEAD.
(C.S.A. Approv. No. 10802) *WRITE FOR LIST No. 104*

All types are also available mounted in portable tanks of standard sizes. Special tank sizes can be supplied to customers' specification. Carrying handles and castors can also be fitted.

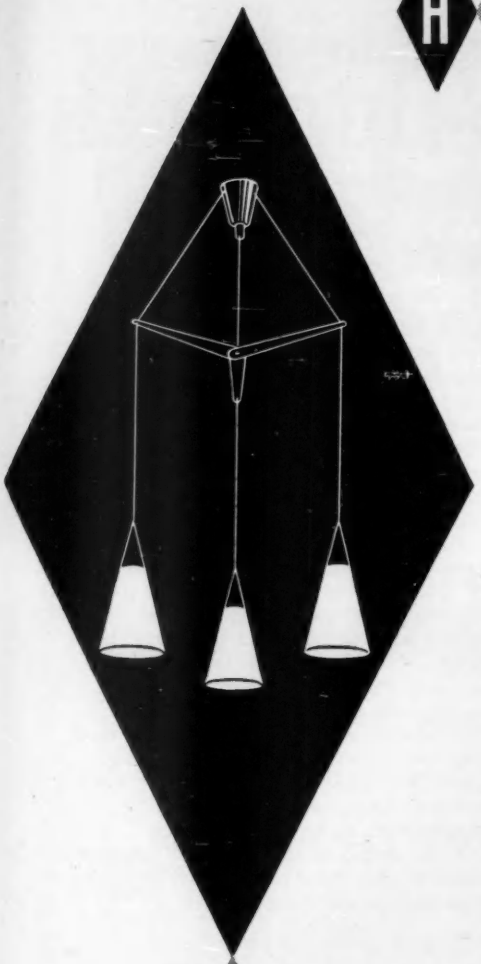
WRIGHT ELECTRIC MOTORS (HALIFAX) LTD.

MANUFACTURING ELECTRICAL AND MECHANICAL ENGINEERS Established 1900

HALIFAX. Grams: "MOTOR" Halifax. Phone: Halifax 60201-2-3

HARLEQUIN

an exciting new range of lighting fittings



Inspired by the costume of Harlequin, Troughton & Young introduce a new range of fittings utilising a number of standard parts in metal, glass and wood. Basically in black and white, the metal parts are also available in a range of four colours at no additional charge. From these interchangeable parts a large array of fittings for every purpose can be built up and supplied for quick delivery. An illustrated leaflet will be sent on request.

TROUGHTON & YOUNG

TROUGHTON & YOUNG (Lighting) LTD., *The Lighting Centre*, 143 Knightsbridge, London, S.W.1. *'Phone KENsington* 3444
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New Landmarks

IN BOILER DESIGN

240,000 lb/hour at 3,300 p.s.i. and 1,060°F

860,000 lb/hour at 1,600 p.s.i. and 1,010°F

Simon-Carves Ltd have broken new ground with two recent orders for boiler plant.

At Margam, for the Steel Company of Wales, they are building a once-through forced circulation boiler to generate 240,000 lb of steam per hour at 3,300 p.s.i. and 1,060°F with re-heat to 840°F.

This is the first Benson-type boiler to be built in Britain and the steam conditions are the most advanced ever commercially used in this country.

At the Padiham 'B' power station of the Central Electricity Generating Board, Simon-Carves are to build a 120-MW reheat boiler unit of the continuous-slagging type. This unit, which will generate 860,000 lb per hour of steam at 1,600 p.s.i. and 1,010°F, with reheat of 785,000 lb per hour to 1,005°F, will be one of the first, if not actually the first, of this type to be built in this country.

It will convert the whole of the ash and the dust into slag and thereby both avert the nuisance of handling and disposing of fine ash and produce a usable product.

At the same time, Simon-Carves are busy at home and abroad on the design and construction of conventional boiler plant—a speciality in which they have long played a leading part.

Complete power plant by Simon-Carves Ltd

SIMON MECHANICAL ENGINEERING GROUP

STOCKPORT. ENGLAND

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SC181

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ELECTRIC COOKING

Thermostats of various types for controlling domestic and industrial ovens. Satchwell Superswitches for infinite regulation of heat input to boiling plates.

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A range of Satchwell thermostats for controlling domestic electric storage and immersion water heaters.

ELECTRIC SPACE HEATING

Satchwell thermostats and contactors for automatic control of electric space heating. QA/QR system controls electric storage heaters according to conditions inside and outside a building.

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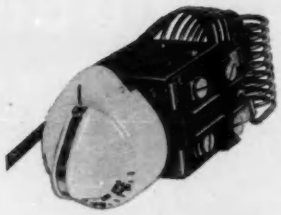
A range of industrial thermostats, two-position and modulating throttling, mixing and diverting valves for steam, hot water and other liquids and gases.

We shall be pleased to send you a copy of our catalogue which covers all Satchwell controls.



Satchwell HCS oven thermostat

Satchwell VK water heater thermostat for pre-set or variable operation

Satchwell XPMF motorized modulating valve

SATCHWELL

THE RHEOSTATIC CO. LTD.

SLOUGH - BUCKS

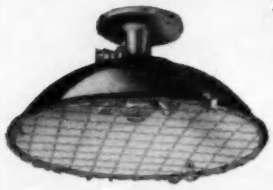
Slough 23961

Eliminate floodlighting troubles with DORMAN

Swivel jointed cluster fitting with hinged glass cover.

Heavy Duty Lighting Fittings

Fixed pattern with hinged glass cover.



Cluster fitting with guard only.

Here is the answer to your floodlighting problems.... DORMAN "Y" TYPE HEAVY DUTY CARGO CLUSTER LIGHTING FITTINGS. Each fitting has six independently wired lamp holders suitable for 100 watt lamps so that in the event of one-lamp failure the remaining five are unaffected thus providing CONSTANT lighting at all times. This modern system entirely eliminates loss of production time whilst costly replacements are made. Other than cleaning the glasses, little or no servicing is required on these robustly constructed fittings which have a wide application for use in ships, warehouses, docks, quarries, site clearing and on cranes, excavations and heavy equipment of all kinds, etc. Portable, fixed and swivel-jointed patterns are available and can be supplied with reflector galvanised or vitreous enamelled as required. The fitting of guards is optional and hinged glass visors are available for fixed and swivel-jointed patterns.

Cluster arrangement.

Galvanised reflector.

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To: Dorman & Smith Ltd., Atherton Works, Blackpool Road, Preston, Lancashire.

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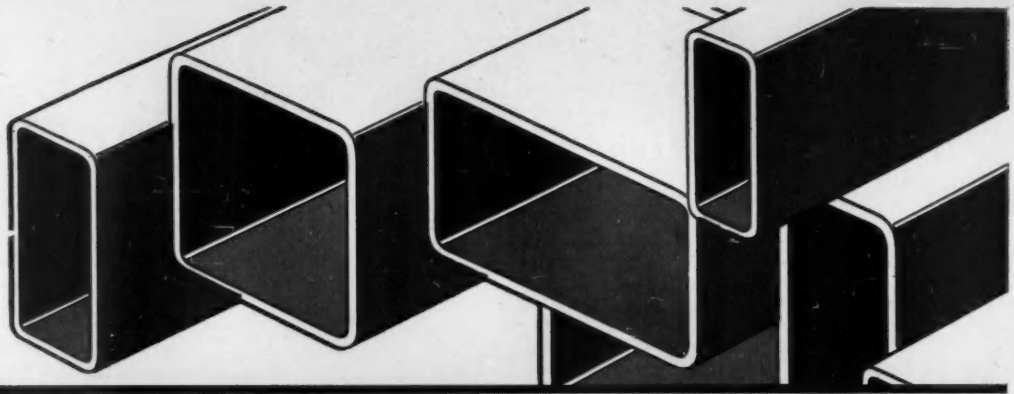
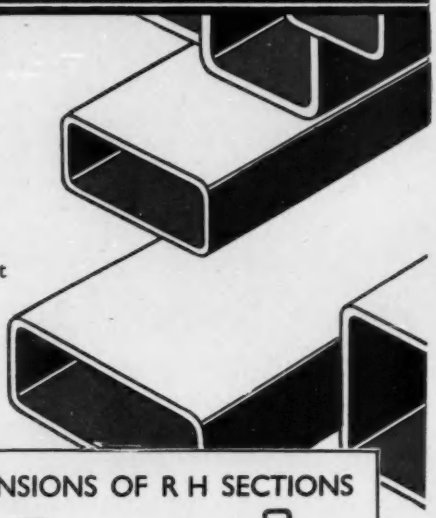


A further advance in tubular steelwork:

RECTANGULAR HOLLOW SECTIONS



Welded tubular construction has made great progress in recent years in its applications to mechanical handling and similar equipment. A further step forward is being made with our new range of hot-rolled Rectangular Hollow Sections. These have been developed in conjunction with our subsidiary, Tubewrights Ltd., who are acknowledged specialists in tubular construction.

SIMPLICITY

R.H. Sections eliminate the need for special shaping of component members prior to welding. Any straight cut R.H.S. or tube will fit accurately against their flat sides whether square-on or at an angle and, moreover, lugs of various kinds produced from tube or bar are easily attached. Welding is simple and no bevelling is necessary.

SIZES

16 standard sizes of hot-rolled R.H. Sections are available, each in two thicknesses; they range from $1\frac{3}{8}$" square to 5" x $2\frac{1}{8}$". Several sections have matching dimensions and this is of advantage in the production of neat fabricated structures. The 1·90" square R.H.S., for example, matches the short sides of a 3·68" by 1·90" R.H.S.; these matching dimensions are made clear in our pamphlet, and in the accompanying table.

Our subsidiary, Tubewrights Ltd., of 25 Buckingham Gate, London, S.W.1, is willing to advise on or quote for any welded sub-assemblies or complete units in R.H.S., in tubes, or in a combination of both.

DIMENSIONS OF R H SECTIONS

INCHES	S.W.G	INCHES	S.W.G
1·36 x 1·36;	11g, 10g	2·44 x 1·36;	11g, 9g
1·90 x 1·90;	11g, 9g	3·17 x 1·59;	10g, 9g
2·125 x 2·125;	10g, 9g	3·68 x 1·90;	10g, 8g
2·38 x 2·38;	10g, 9g	4·76 x 2·38;	9g, 7g
2·50 x 2·50;	10g, 8g	1·90 x ·82;	11g, 10g
2·79 x 2·79;	10g, 8g	2·79 x 1·01;	11g, 9g
3·57 x 3·57;	9g, 7g	3·40 x 1·36;	10g, 9g
MATCHING DIMENSIONS ARE SHOWN IN HEAVY TYPE		3·99 x 1·59;	10g, 8g
		5·01 x 2·125;	9g, 7g

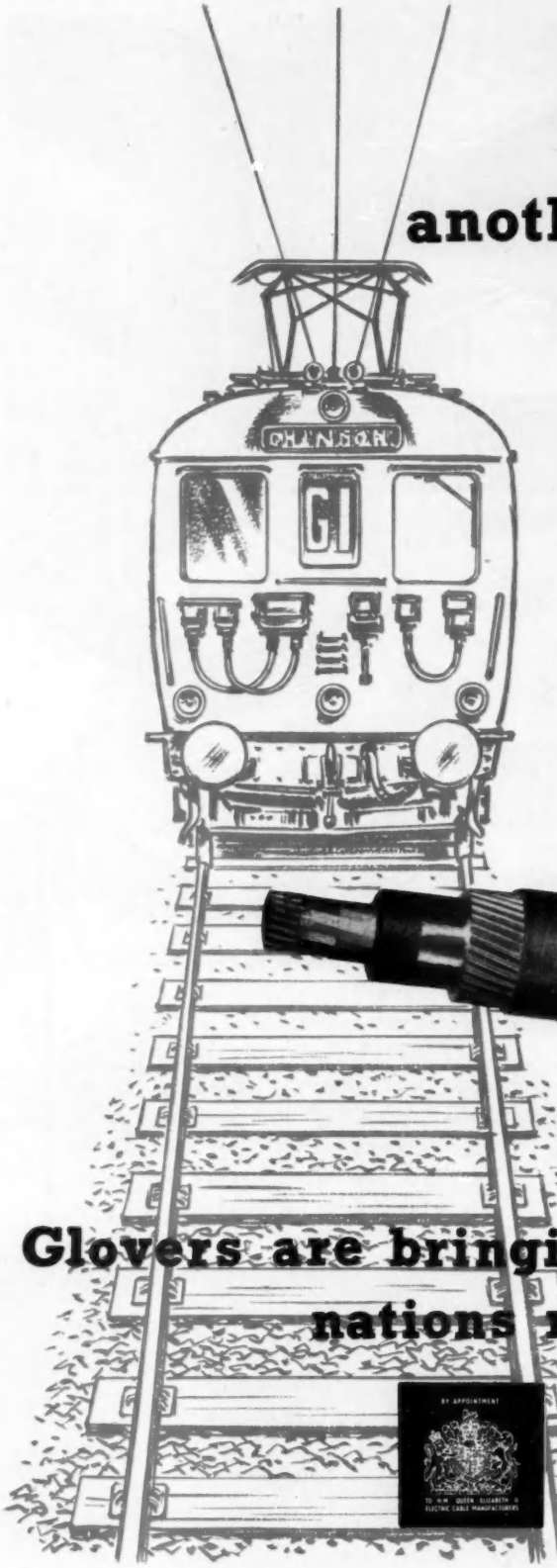
STEWARTS AND LLOYDS WAREHOUSES THROUGHOUT THE COUNTRY STOCK R.H.S.

Pamphlet giving full dimensions, properties and prices will be sent on application to:

Stewarts and Lloyds Ltd

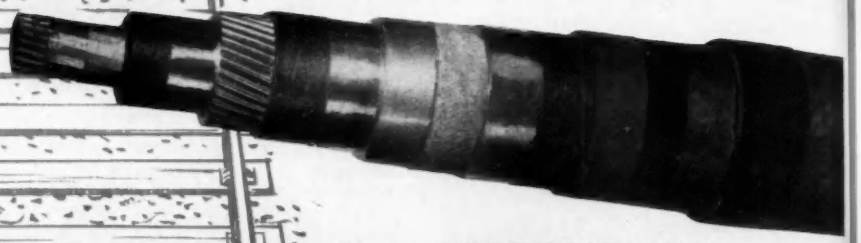
STRUCTURAL STEEL DEPARTMENT,
BROAD STREET CHAMBERS, BIRMINGHAM, 1

STEWARTS AND LLOYDS S&L RECTANGULAR HOLLOW SECTIONS TUBEWRIGHTS



another Glover achievement

The British Transport Commission have selected the Glover designed 25 kV. single phase, 50 cycle concentric gas-filled cable for the initial stages of the railways modernisation scheme in the Scottish Region.



25kV 0·2/0·2 CONCENTRIC GAS FILLED CABLE. THIS DESIGN OF CABLE HAS BEEN FULLY TYPE APPROVAL TESTED.

Glovers are bringing POWER to the nations railways

BY APPOINTMENT TO H.M. QUEEN ELIZABETH II ELECTRIC CABLE MANUFACTURERS

W. T. GLOVER & CO. LTD
TRAFFORD PARK MANCHESTER

TAKE YOUR PICK

Our wide range of capacitors, incorporating all the very latest developments, are described fully in these new leaflets . . .

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METER BOARDS

carry a load of responsibility and never let you down

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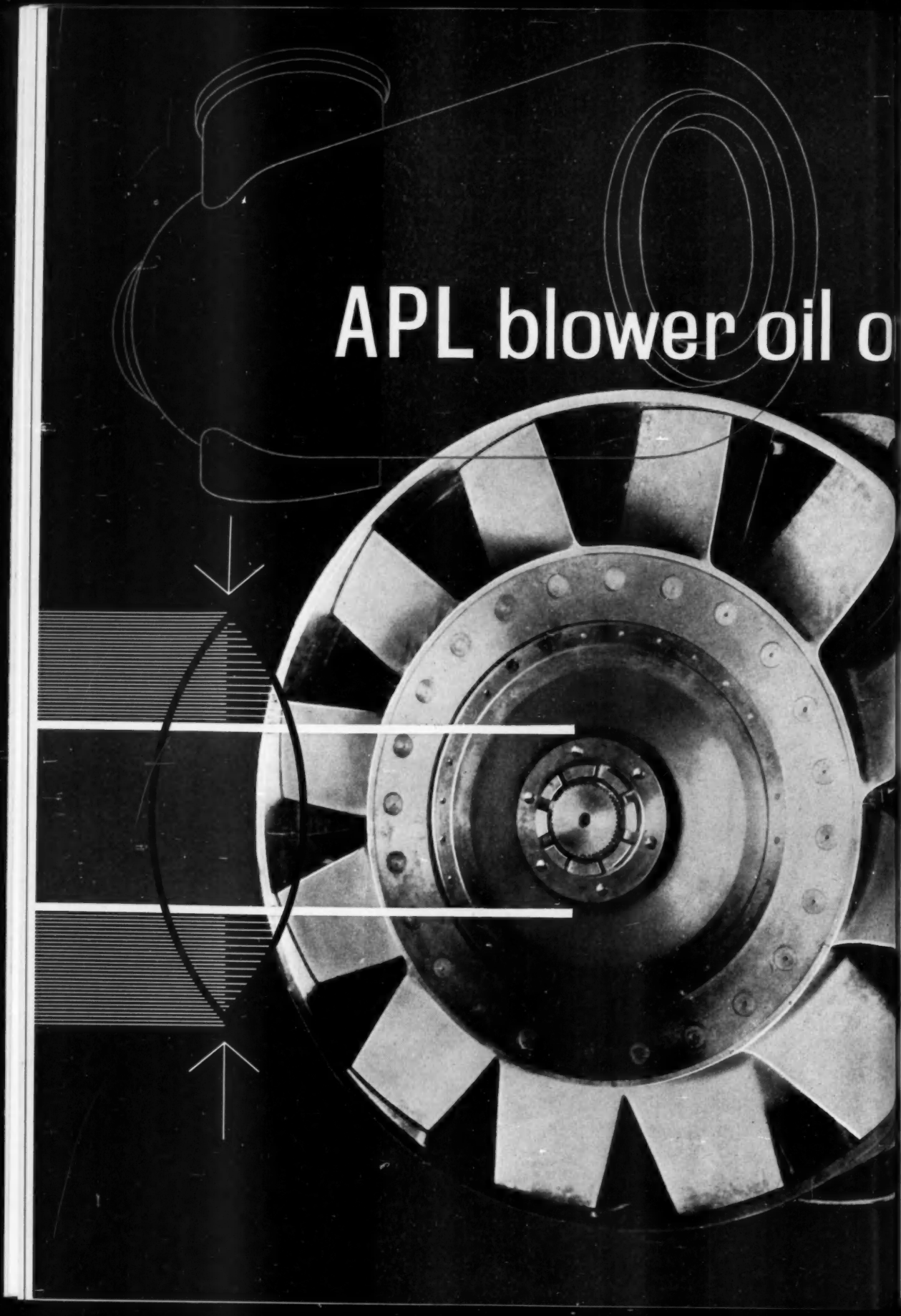

APL blower oil o

TRIUMPHS OF SHELL RESEARCH . . . 3

sentry-go at Bradwell...

The crucial points of the high pressure CO_2 coolant circuit at Bradwell will be the blower shaft seals. Every minute of every working day Shell APL blower oil will guard these escape points—being continually pumped into the seals and bearings, led away, purified and recirculated.

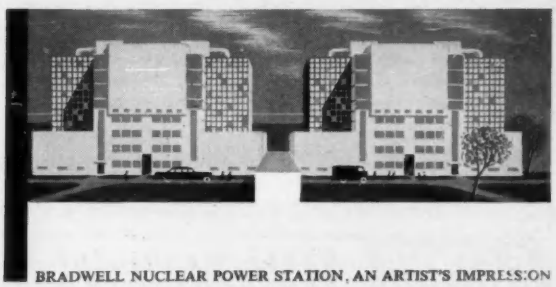
This very remarkable oil presents a two-way seal. Outwards, there is a minimum CO_2 loss as the oil has the lowest possible gas solubility. Inwards, in spite of the heat of the gas, oil vapour contamination is negligible thanks to the extremely low vapour pressure of the oil.

The research that went into APL blower oil is characteristic of the way Shell set about doing things. It was conducted at Shell's Research Centre at Thornton in close collaboration with the U.K. A.E.A. and the blower manufacturers. In the course of much fundamental research, a wide range of oils was subjected to vapour pressure and gas solubility tests in the laboratory. Selected oils from this range were used in the bearings and seals of a blower rig. In 1956, after four years of research, the finished product joined the Shell Atomic Power Lubricants range—marketed under the name of Shell APL 729. This oil has been in use at Calder Hall since the autumn of 1956.

The moral of the story is that Shell research is supremely applicational. The Centre at Thornton is always ready to work with even the most specialised sectors of industry to produce the right oil for the job. If you and your organisation have any major lubrication problem it pays to get in touch with your local distributor of Shell Industrial Lubricants.

The Research Story

Though the sealing action demanded of Shell blower oil is common in other industrial equipment such as hydrogen-cooled alternators, there were quite a few additional problems. It was necessary for the oil to have long life, low vapour pressure, low gas solubility, good thermal stability and high film strength —to be able to withstand high temperatures and to be resistant to all kinds of corrosive influences, including carbonic acid. The crux of the research was to combine all the above requirements into one oil, in order to minimise back diffusion of molecules which would contaminate the reactor.



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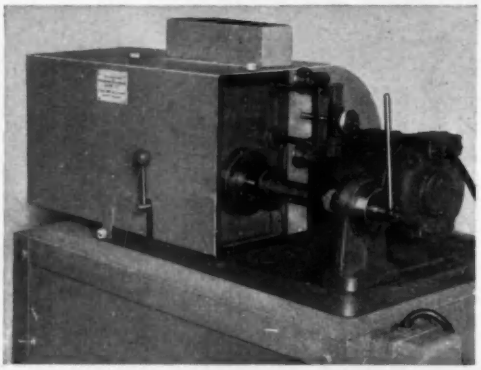

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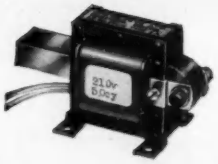

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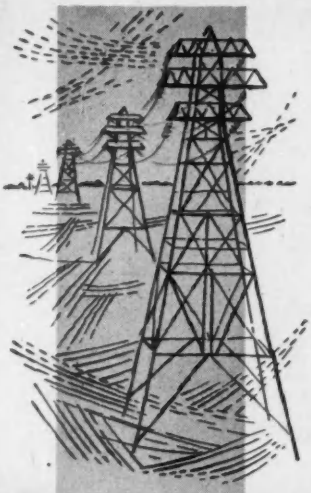
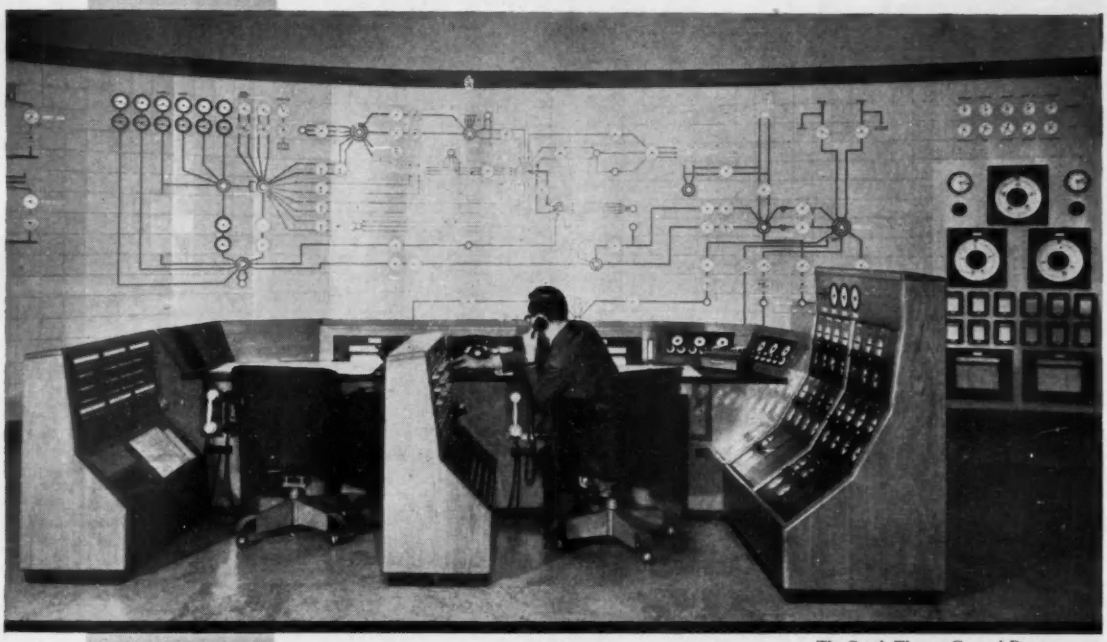


Standardised Systems of General Indications, Telephony and Telemetering for the CENTRAL ELECTRICITY GENERATING BOARD



The South Thames Control Room

Control and telecommunication systems throughout the electricity supply network (the grid) of the Central Electricity Generating Board have been modernised and standardised by the establishment of a number of new grid control centres. The General Electric Co. Ltd., was responsible for supplying and installing two of these centres, at South Thames (London) and at Birmingham.

This is part of a programme for a "Standardised System of General Indications, Telephony and Telemetering" initiated in 1949 by the C.E.G.B. (the then British Electricity Authority) in collaboration with the Automatic Telephone and Electric Co. Ltd., Standard Telephones and Cables Ltd., and The General Electric Co. Ltd. This standardised system forms a major contribution to improving the operating efficiency of the supply network.

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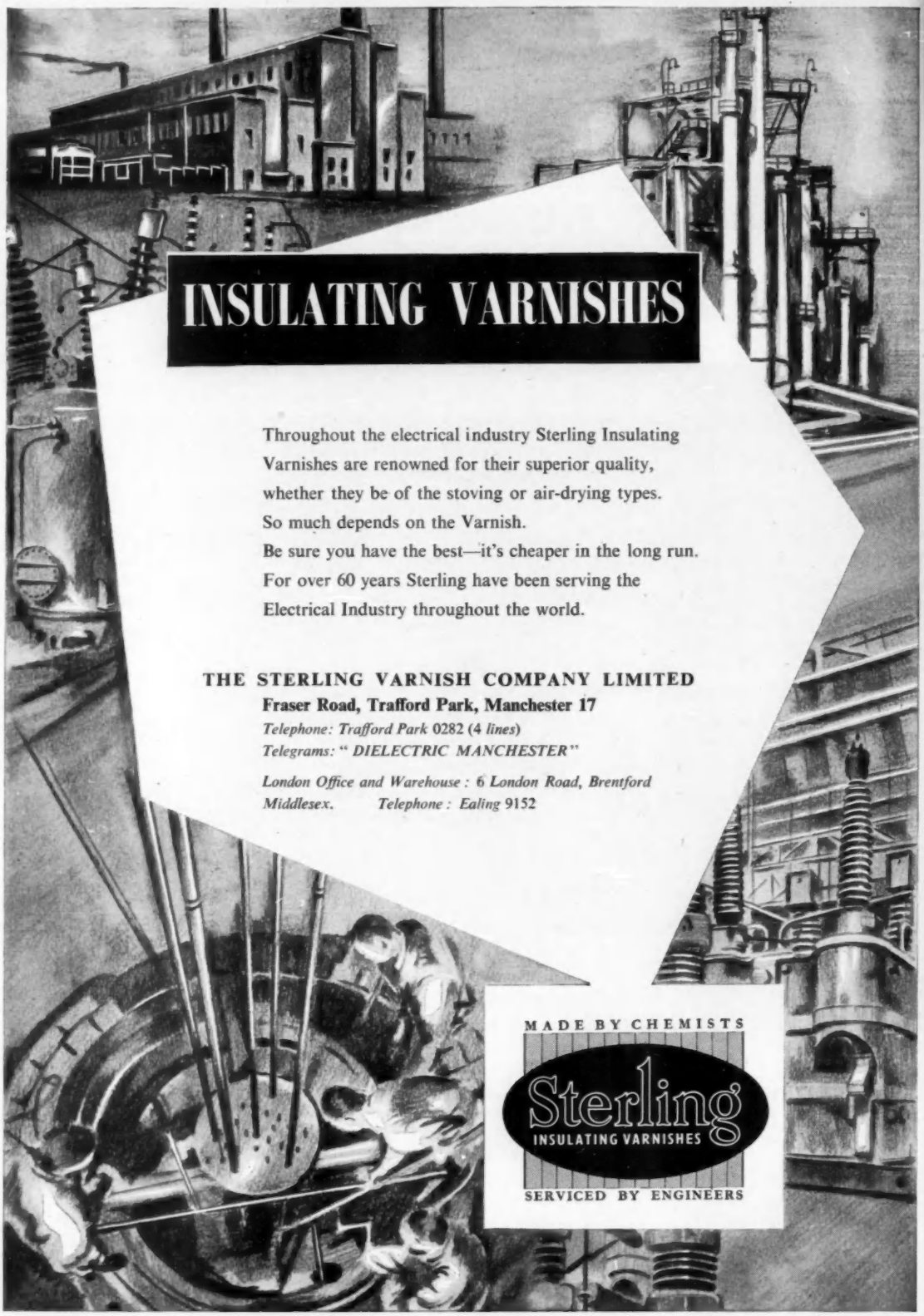

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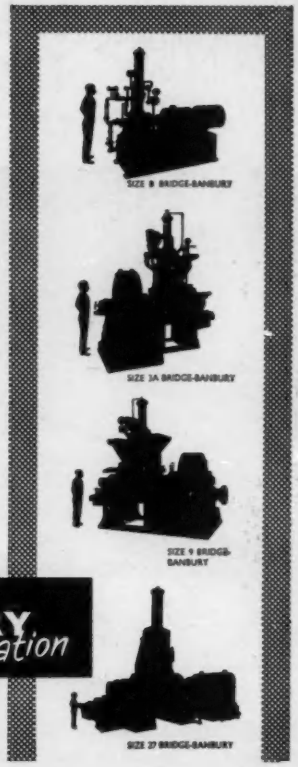

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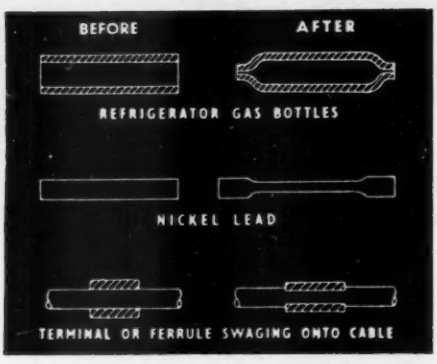
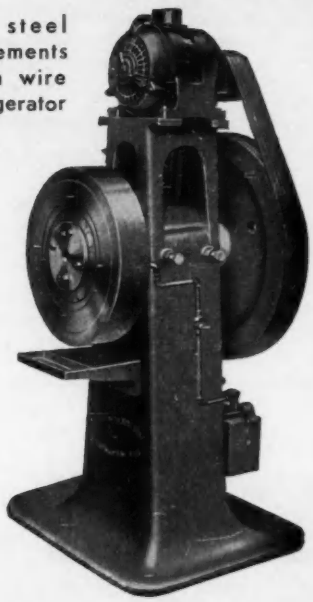
What is Rotary swaging

It is a means of reducing or pointing tube and rod by a hammering process



Reducing powder filled steel inconnel and copper elements Tungsten and Molybdenum wire for filaments. Necking refrigerator gas bottles.



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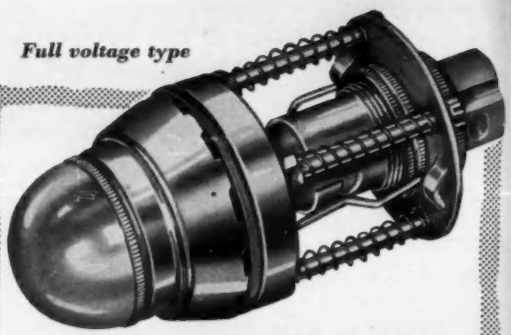

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block schematic

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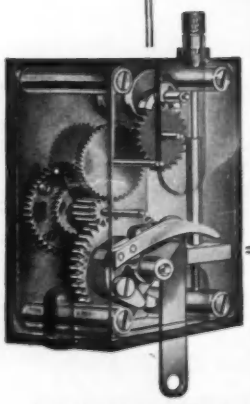

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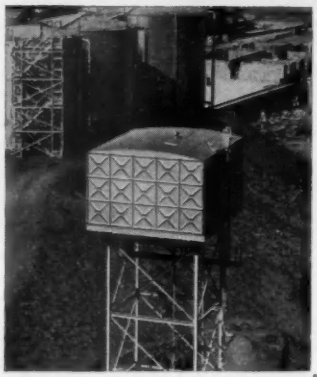

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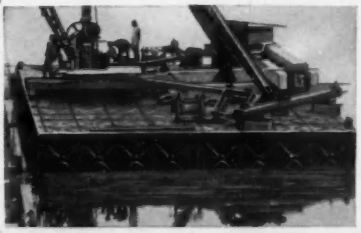

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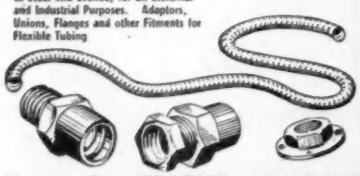

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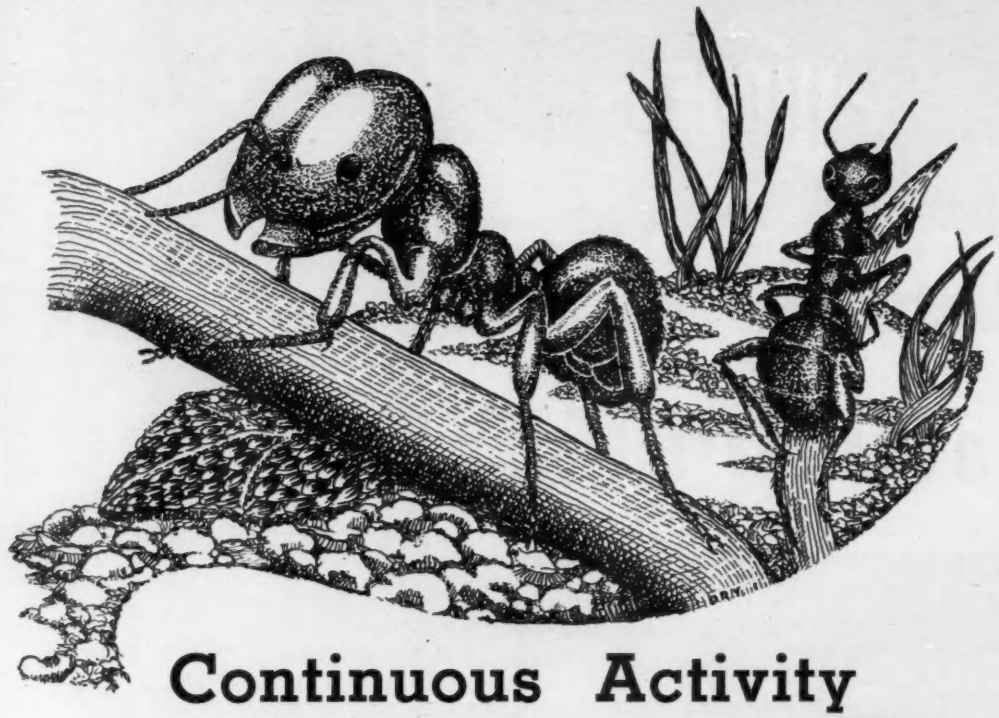

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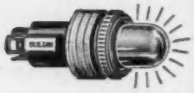

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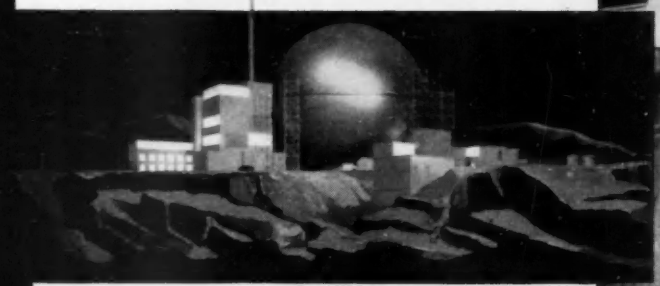

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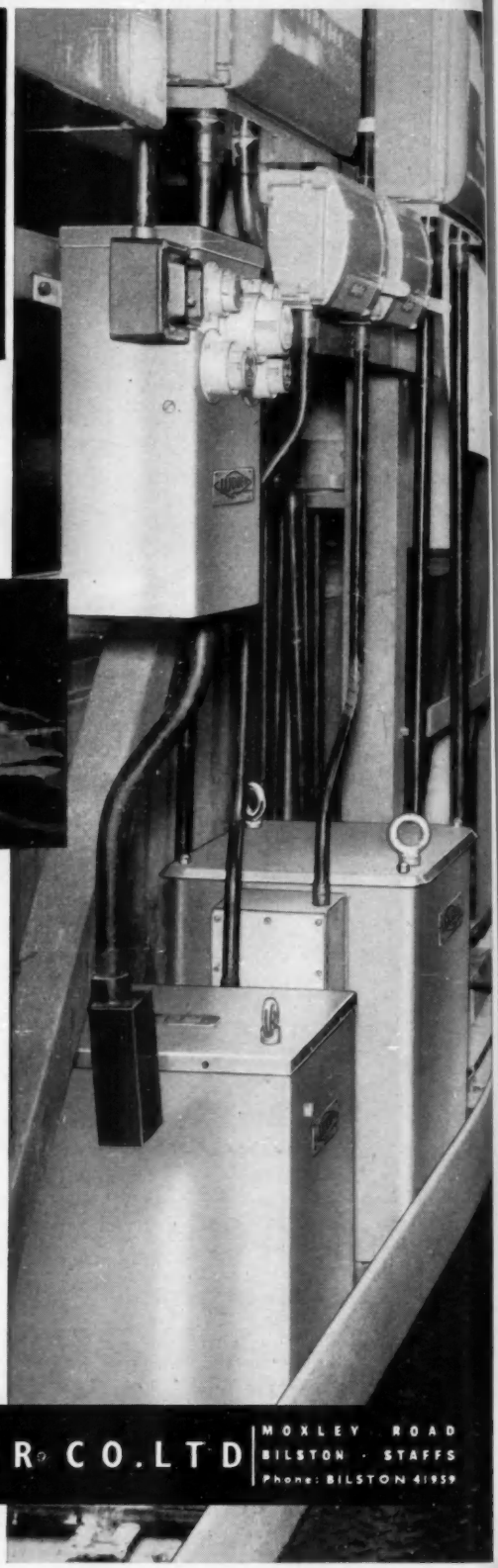

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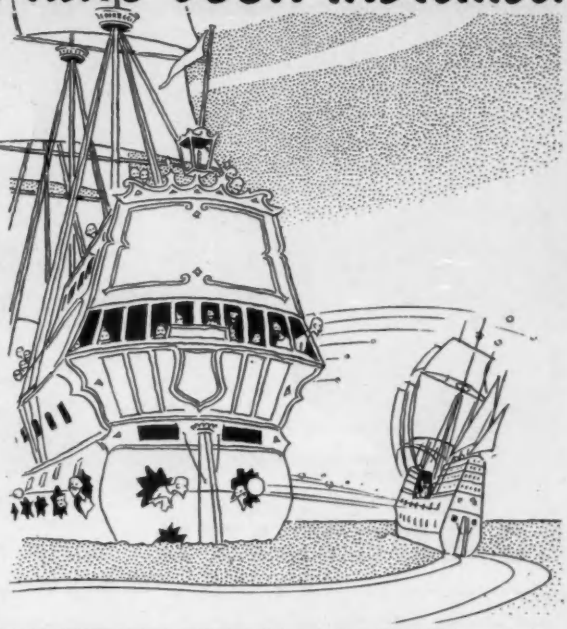
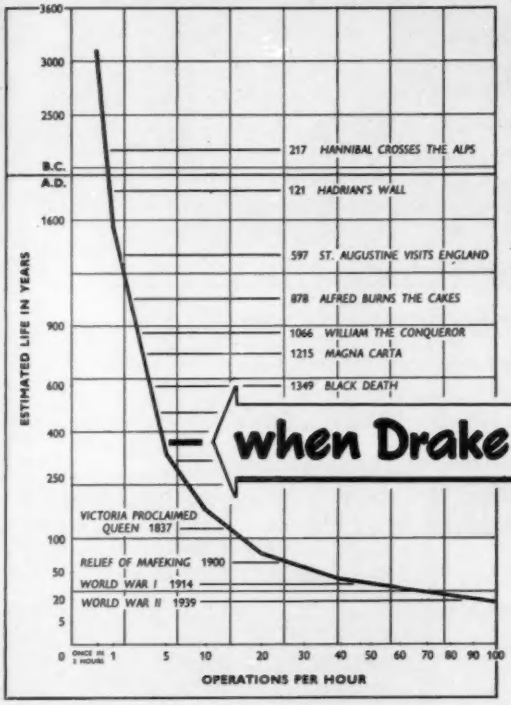
if this CRABTREE starter could have been installed



GRAPH SHOWING TIME TAKEN IN YEARS RELATED TO 4,100,000 OPERATIONS PERFORMED BY CRABTREE TYPE B-15 CONTACTOR (BASED ON A 50-HOUR WEEK AND A 52-WEEK YEAR)



when Drake defeated the Armada

Type B-15 contacts, on actual motor-load life tests, have already achieved 4,500,000 operations (start and stop) and are still giving satisfactory service

The contacts would now need inspection

Tests are now proceeding in which Crabtree Type B-15 starters are being used for repeatedly stopping and starting motors. To date the starters have given the following operations (start and stop) without change of contacts:

ACTUAL TEST FIGURES:

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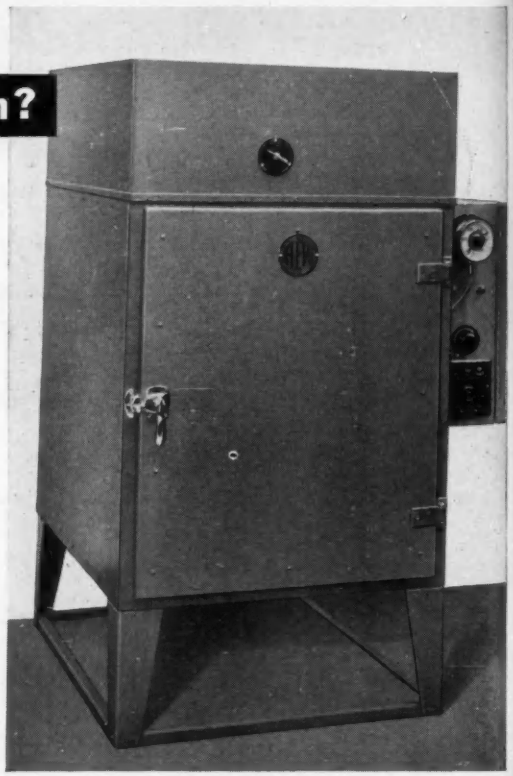

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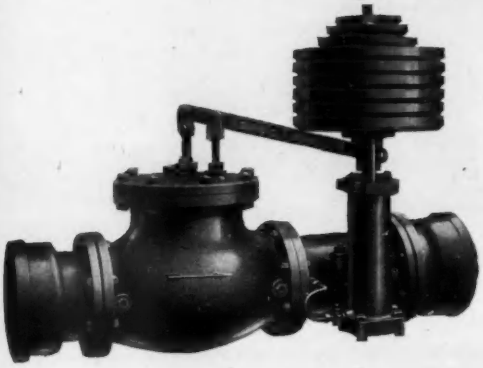

Auxiliary Water Lines, such as those for domestic and fire fighting purposes, no less than the circulating water systems, require flow control valves. Whatever the need, it can be met from the Glenfield range, from which only a few typical examples are illustrated, covering Check, Pressure Reducing, Air, and outside and inside screw Sluice valves.

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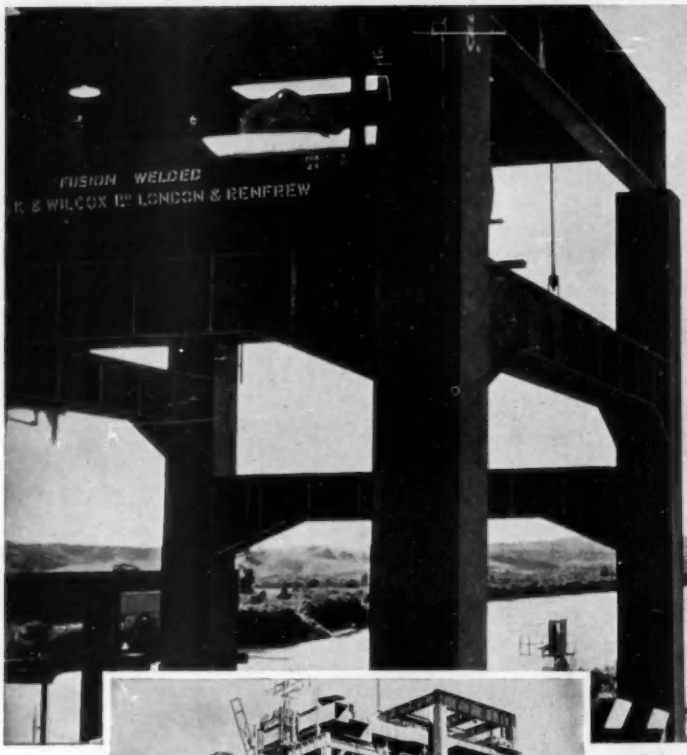
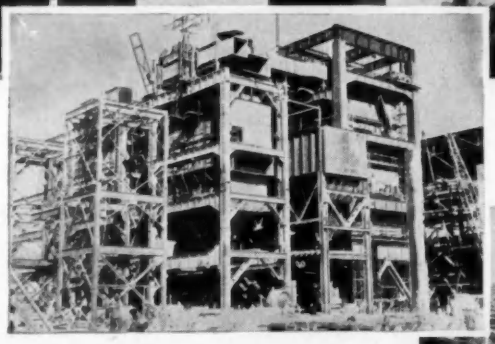


THERMAL POWER *for* NEW ZEALAND



Above and left: Boiler plant during erection at the Mercer power station.

Below: Aerial view of the site on the Waikato river. Fuel will be supplied from the nearby Maramarua coalfield.

In a country where the main source of power is hydro-electric, New Zealand's largest steam power station, now approaching completion near Mercer in the North Island, for the New Zealand Government, is of particular interest.

Being built in one continuous operation, for a capacity of 180 MW, divided between six 30 MW generators, the station is equipped with six Babcock pulverized-fuel-fired Radiant boilers each to supply 300,000 lb./hr. at 635 lb./sq. in., 865°F., in a "semi-outdoor" type installation.

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FRIDAY
5 DECEMBER
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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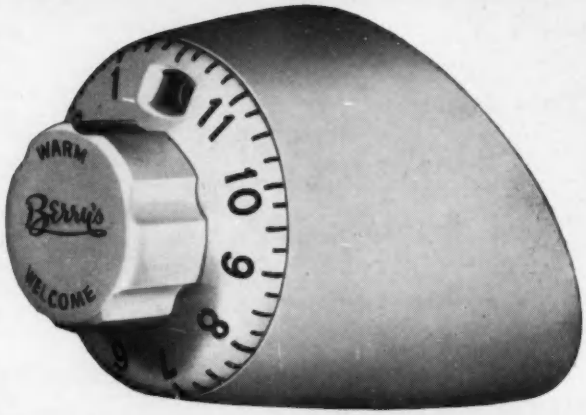

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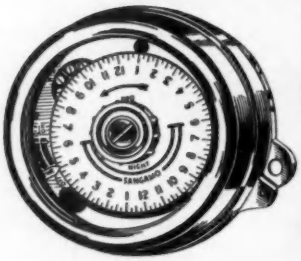

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ELECTRICAL REVIEW

5 December 1958 Vol. 163 No. 23 Established 1872

Closing the Loop

THERE is no such thing as a completely automatic machine: that is a machine which will process raw material to make a final product without being " programmed " by a human being. The word automation has been defined countless times and the definitions range from ultra-mechanisation to the use of automatic control systems and computers for a continuous process.

The dictionary definitions of automation can be boiled down to " self-acting." Usage has brought into the dictionary definitions the qualification that the process is an unthinking routine. Practical definitions have, so far, been merely specific examples of an automatic process, e.g. " a large number of machines integrated into one fully automatic self-regulating system." But automation can be applied to paper-work as well as manufacturing processes. In fact, it is more easily applied to offices than to factories. The definition of automation should therefore be more particular than " self-acting " and yet wider than those definitions concerned only with machines. The definition should be a kind of formula which can be applied to any given process. If the process complies with the definition, then it is automation.

It must first be decided whether to define automation by the studying of the mechanism of the control system or its behaviour. Man's mental powers cannot be imitated and he must therefore give the initial instructions and programme to the apparatus controlling some automatic process. Even if it is an extraordinarily clever machine, he must at least supply a drawing of the production article required. This means that the word automation must encompass a process on some lower and entirely different level from that of man's thought mechanism. That is, it involves a device incapable of original thought but able to make decisions.

In his Faraday Lecture, Dr. Thomas defines automation by the behaviour of the system. He asserts that automation occurs when some of man's mental processes are carried out by the control system. We feel that this complies with all we have said above and can be applied to many processes.

An automatic system can be divided into four essential parts: mechanical handling of the product, the manufacturing process of the product, the sensing of the required dimensions of the product, and the control circuit. So far as automation is concerned the essential part of the process is the control system. This control system must have some sort of feed-back, to close the control loop, so that decisions can be made to correct

any errors detected by the sensing equipment. Without feed-back the whole process is mechanisation and a human being has to close the loop and provide the feed-back. Thus, automation occurs when a control system, programmed by man, closes the loop and replaces the operator. This complicated system, of course, can be applied economically only to mass production.

One of the distinctive characteristics of automation is that it is based upon and uses complex equipment embodying electronic devices and electronic techniques. Electronic devices have unequal sensitivity and speed and they have thus become indispensable factors. They are usually incorporated in a computer which can operate only in accordance with the instructions issued to it although it is capable of making programmed decisions. Their activity is similar to that expected from a "moron," which is the very descriptive term used by Dr. Thomas but, as he says, if these morons are programmed by intelligent people they can be made to do very remarkable things.

PATTERN OF TRADE

In referring to the importance of the Commonwealth as the largest market for British electrical goods there is a tendency to think of it as a homogeneous unit. This is misleading because each Commonwealth country has its own problems, requirements, and rate of development. Canada, for instance, is already outside the general pattern of Commonwealth trade, and the recent reductions in the margin of preference on British goods allowed by New Zealand, following on similar reductions made by Australia and proposed by Malaya, must be seen as part of the trend in primary producing countries to gain a greater flexibility in their trade and reduce their dependence on the slow-growing British market.

If then the Commonwealth is considered as a collection of loosely-linked and individual countries the significance of other, often more rapidly expanding, markets is the more apparent. In particular Germany offers good opportunities for such products as domestic appliances, which have suffered most from the restrictions imposed by Commonwealth countries to protect their own local industries. Whatever the outcome of the negotiations over a Free Trade Area, Great Britain and Germany will each be the most rewarding customer of the other. It is to be hoped, therefore, that British manufacturers will not rest content with receiving the party of German retailers visiting Great Britain this week but will themselves extend their visits to the Continent. As in the Commonwealth, a vigorous sales policy based on quality goods is the only sure basis for expansion.

DIRECT NUCLEAR GENERATION

The ideal method of generating electricity from nuclear energy would be to do so without making use of a steam cycle between the reactor and the generator. In this country it is possible that ZETA may eventually be developed to a stage where it will produce electricity in this way. A report in the November issue of the *Electrical World* describes research which is being conducted with this end in view by the American Westinghouse Electric Corporation. Their idea is to use thermoelectric materials in reactor fuel elements. Basically the nuclear fuel would be encased in a thermoelectric material, say of type A, and an adjacent fuel element would be canned in a material of type B. It would then be necessary to have a temperature difference across the two fuel elements. If this is possible electric power would be generated directly in the reactor. The system would deliver direct current to the transmission system. There would be some heat generated but this could be dissipated by conventional means.

Although the design of this type of system has not as yet progressed very far, Westinghouse engineers visualise a thermoelectric nuclear fuel element as a flat plate with electrical connections at each end. The nuclear fuel would serve as a heat source and it would be canned to prevent a spread of radioactive products and the thermoelectric material would surround the fuel element. If this type of arrangement could be made to work it would undoubtedly possess simplicity of design and construction. There are also good prospects of a higher efficiency of operation than one could get by making use of the heat cycle and its attendant boilers, turbines and rotating machines.

This matter will no doubt be considered in the course of the Convention on thermonuclear processes which the Institution of Electrical Engineers has arranged to take place next April. In fact it is definitely stated in the advance notice of the Convention that reviews of related work in the U.S.A. and the U.S.S.R. will be included in the programme.

TRANSISTORS AND SEMICONDUCTORS

It is now ten years since the invention of the transistor revolutionised ideas on the size and shape of established electronic equipment. The impact of this unique circuit element since then has more than lived up to early speculations and today semiconductor research is universally recognised as one of the most important areas of science. During the past ten years something like 800 different types of transistor have been developed and semiconductor research has given rise to improvements in, or developments of, hundreds of other semiconductor devices such as diodes, rectifiers and photocells.

Because of their extreme compactness, low power consumption, long life and robustness, the transistor and these other devices are inaugurating a new era of electronics. Although the transistor is not a British invention, the electronics industry and the many associated research organisations in this country are well to the fore in the development of transistors and other semiconductor devices. The Institution of Electrical Engineers is to be congratulated on organising the international convention on the subject which is to take place in London next year and is referred to in this issue. The scientific exhibition which will be held in conjunction with the convention will undoubtedly reveal the great progress which has been made and at the same time foreshadow the pattern of future advances.

NEW S.T.C. FACTORY AT HARLOW

The largest factory in Harlow New Town, Essex, is operated by Standard Telephones & Cables, Ltd., and is devoted exclusively to the manufacture of selenium rectifiers and certain semi-conductor devices. The factory has a floor area of nearly 200,000 sq ft and is capable of being expanded up to 250,000 sq ft. This article describes the layout of the works and the various processes involved in the manufacture of selenium rectifiers and silicone and germanium semi-conductor devices but excluding transistors

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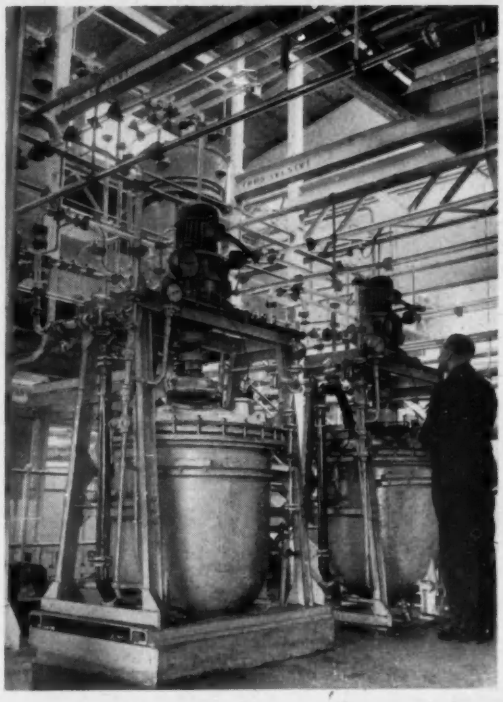
As business grew, the rapidly expanding plant at Boreham Wood could not provide under one roof the co-ordinated facilities necessary for efficient production, and it was therefore decided in 1952 that a factory should be designed and built to meet the specific needs of the Rectifier Division. It was decided to establish the factory in the new town of Harlow, Essex. Apart from the many other factors involved, housing could be provided for the staff at a time when there was an acute shortage.

This factory has now been completed and is in full operation. It is the biggest in Harlow and has been built on an 8½ acre site and the present covered floor space amounts to about 189,000 sq ft. A two-storey administrative block containing offices, laboratories, restaurant, cafeteria and kitchen has a frontage running along Edinburgh Way, and two main production buildings, served by internal access roads, lie behind this block. Each production space has been planned for expansion so that ultimately some 250,000 sq ft will be available. The first of these two buildings is devoted mainly to the manufacture and processing of components, and the second to the assembly and testing of equipments, and these considerations have largely influenced their design.



General view of the selenium reaction vessels with feed tank of solution in the upper background

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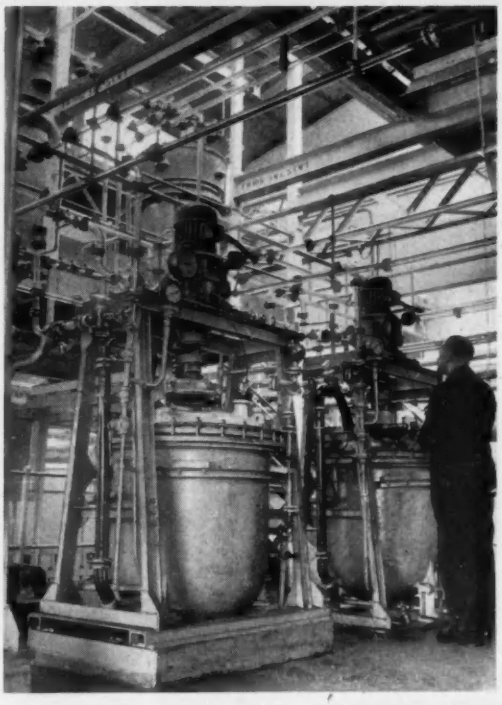


General view of the selenium reaction vessels with feed tank of solution in the upper background

Application of selenium powder to master sheets by means of an automatic sprinkler box

Hot pressing operation for fusing the powdered selenium on to the master sheets. The tray is about to be inserted between the heated plattens of a hydraulic press

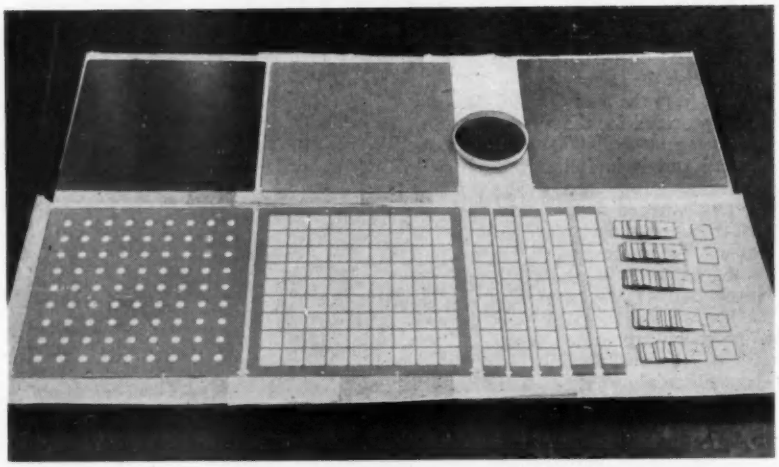
Ancillary buildings containing the main electricity supply substation, stores, maintenance workshops and fire station flank the eastern roadway, while a personnel and medical block has been constructed near the western factory entrance. The factory, both internally and externally, is a fine example of contemporary architecture where spaciousness, clarity and the pleasant atmosphere of modern decoration offer healthy and agreeable working conditions. A general landscape scheme has been carried out with neat lawns and shrubs as the predominant feature, and those areas scheduled for future expansion have been grassed over and planted here and there with shrubs of less virile growth.

The main factory area is devoted to the function for which it was originally designed, that is, the manufacture of selenium metal rectifier plates and their assembly into rectifier stacks. The pattern of the manufacturing areas in the factory inevitably changes as the latest semi-conductor material, silicon, plays an increasingly important part in rectifier production.

In 1938, when the selenium rectifier was first introduced into this country by S.T.C., the method of manufacture was largely a laboratory process and therefore not suitable for large quantity production. Since that time continuous and extensive development has resulted in great technical improvements, particularly with regard to operating voltage, current and temperature. The method of manufacture has been completely changed to a mass production process, which now enables rectifier plates to be made at the rate of millions a year.

The basic raw material for this rectifier is selenium which is delivered to the factory as selenium dioxide. Selenium itself is derived as a by-product from copper refining with Canada as the principal source. Firing to form the dioxide is a convenient first-stage refining process carried out by the Mond Nickel Company. At Harlow it is further purified for semi-conductor use in a plant comprising temperature-controlled porcelain and glass vessels.

An aqueous solution of selenium dioxide goes through a controlled reaction with sulphur dioxide to produce a slurry of selenium sulphuric acid, siphoned off into filters and washing containers from which it is subsequently removed as a "cake." The "cake" is then dried to a powder in an air oven, and an additive is introduced by spin mixing. Next, the powder mixture is melted at 420 deg C in electrically-heated crucibles after which it is de-scummed and then poured on to cooling plates. The cooled slab of vitreous selenium is then broken up and put into an electric pestle type pulveriser. From the pulveriser the vitreous selenium is transferred to a pin grinder which reduces the material to a finely powdered



Stages in the production of a selenium rectifier. Top left to bottom right:— Untreated steel master sheet, etched sheet, powdered Se, Se coated sheet, insulating paint for centre contact applied, counter-electrode stripped, sheet cut into strips, finished rectifier plates

state. The resultant powder is then graded through sieves. Quality control is exercised throughout all stages of the process.

Aluminium or steel base plates are used in " Sentercel " selenium rectifiers, the plates being etched in a carefully controlled manner to provide a keying surface to take the semi-conductor materials that are supplied. At Harlow the aluminium plate etching plant is semi-automatic, while the steel plate plant is fully automatic. All plates are carefully inspected for blemishes after etching, and are then graded into batches of plates of the same thickness. This thickness grading is carried out to an accuracy of $\pm$0·001in since the subsequent controlled deposit of semi-conductor material depends on the provision of a uniform thickness of plate in each batch treated.

The pulverised selenium is applied to the base plates by special methods which control the quantity and evenness of distribution of the powder. The plates bearing the powder are then put into time and pressure controlled hot presses for a short period. Next, the plates are transferred on endless belts through tunnel ovens where an accurate control and uniformly distributed heat are achieved by using liquid naphthalene as the heat source.

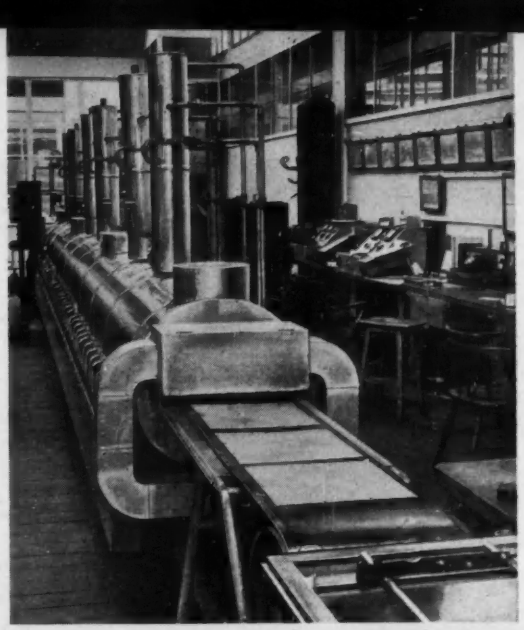
One of the features of the " Sentercel " rectifiers is the use of an insulating medium to provide a " dead " centre where assembly pressure is subsequently applied. Adhesive paper insulators or paint insulating films are applied to the plates prior to the application of the counter-electrodes. Artificial barrier layer treatment then takes place depending on the type of rectifier being produced. One common method is the application by spraying of an organic film of molecular thickness on to the selenium surface. The metal alloy counter-electrode is then sprayed on to the plates. This is done manually on some of the production lines where the type of plate requires the attention of an operator to carry out the spraying. In other production lines the molten counter-electrode is sprayed entirely automatically.

Although some plates are still treated individually, the general procedure is to process large sheets or matrices and cut the smaller elements from them as a last stage. The final process consists of an activation of the barrier layer, known as electro-forming. This involves a period of soaking for each element under a d.c. stress, and efficient transfer of dissipated heat is achieved by immersion in temperature-controlled oil baths. The finished plates are then tested electrically, graded, and put into store ready for use as required by the rectifier stack assembly workshop.

Much of the rectifier production is sold as basic rectifier stacks, all of which are finished with a special paint to protect the sensitive elements from deleterious atmospheres. Part of the output of the factory, however, is built into rectifier equipments, assembly of which is carried out in a separate block. Standard ranges of transformer/rectifier equipments are manufactured, but many of the units are made to suit particular requirements of customers, and are usually for high-voltage and/or heavy current applications. All the transformers and the chokes used in S.T.C. rectifier equipments are made in the Harlow factory.

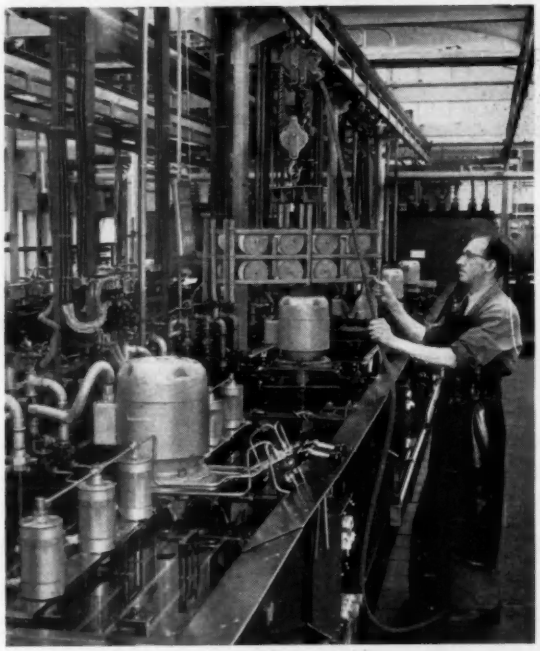
Germanium junction photo-electric cells are also manufactured in the Harlow factory. Manufacture has been standardised on two types: a miniature cell for industrial counters and automatic control equipment and a sub-miniature type suitable for mass grouping in such applications as computers and high-speed telegraphy equipment where the scanning of punched cards or tapes is involved.

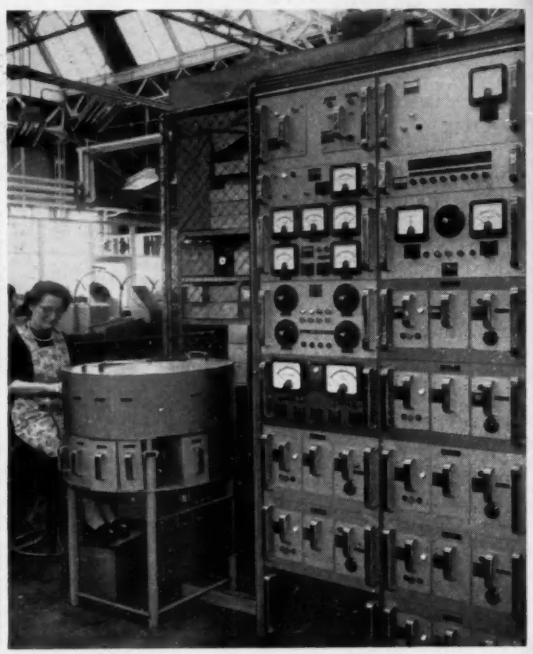
The germanium photo-diodes are based on a diffused junction technique using " n " type material and gold as the acceptor element. One of these, the PG40B, is of exceptionally small size; it has a diameter of 0·08in to permit a pitch spacing of 0·087in for reading the holes in punched cards. A wide range of Si rectifier diodes is also made with basic current ratings of ½ A, 1 A, 5 A and 100 A. One watt size Zener diodes covering the range 3·3-15 V with 5 per cent tolerances are among the latest products. Both 0·5 A and 1 A silicon rectifiers and Zener diodes use the alloy type of junction made from " n " type silicon with an aluminium wire providing the " p " type region. By the use of wire, connection to the " p " region is rendered much simpler since, in



Selenium coated master sheets being treated by passing through a naphthalene oven

Application of the metal counter-trelectrode by means of a hand-operated spray gun. This consists of an electrically heated container, the molten metal passing through an atomising jet fed with compressed air





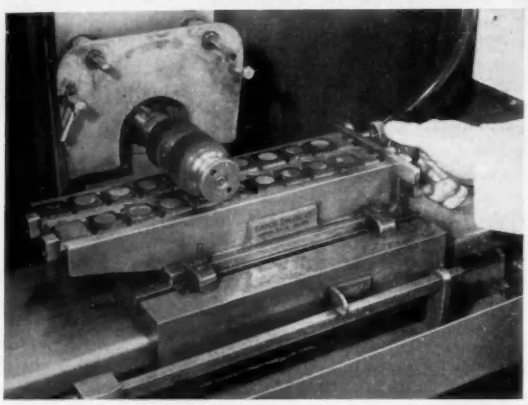
Left: View of the selenium plate electrode-forming equipment. Right: Apparatus for the automatic testing of selenium rectifier plates and sorting them into pre-selected forward and reverse quality groups

effect, the tip of part of one of the lead wires to the device is alloyed right into the silicon itself. A special apparatus has been developed by the company to carry out this operation.

As with all semi-conductor devices great care and attention has to be paid to surface cleanliness and the effect of ambient atmosphere. The operations of assembly are therefore carried out in an air-conditioned room in which the relative humidities are controlled to less than 40 per cent. Glass-to-metal hermetic seals produced by the Transistor Division at Footscray, Kent, are used for the encapsulation of the junction employing carefully worked out soldering techniques.

In the case of the 5 A rectifier diode a diffused type of junction is used which is based on "p" type starting silicon and phosphorus as the donor element. By suitable metallising of the silicon surfaces connection by direct soldering is possible. However, for encapsulation a cold metal forming operation is employed to secure the cover cap to the base and a crimped-on lead wire. A stud is provided for fixing the diode to a suitable heat sink.

The 100 A diodes are constructed from an "n" type silicon slice with an aluminium alloy junction. The area of junction formed has been carefully chosen to provide an economical current density consistent with an appreciable safety margin to permit the handling of substantial overloads or current surges. This aspect of the device design is of increasing importance since it is well known that single-crystal semi-conductor devices are more sensitive to abuse than their cousin the selenium rectifier. Other features of the device are the use of the cold



Dicing slices of silicone single crystal using ganged carborundum saws

Left: The assembly of selenium rectifier stacks for use in domestic radio receivers

forming method of closure and flexible braid to provide expansion jointing internally.

The construction of silicon diode stacks follows on logically from the well-established procedure with selenium rectifiers. All the various circuit configurations can be built up into one convenient unit, together with other arrangements providing a multiplicity of series or parallel diode elements.

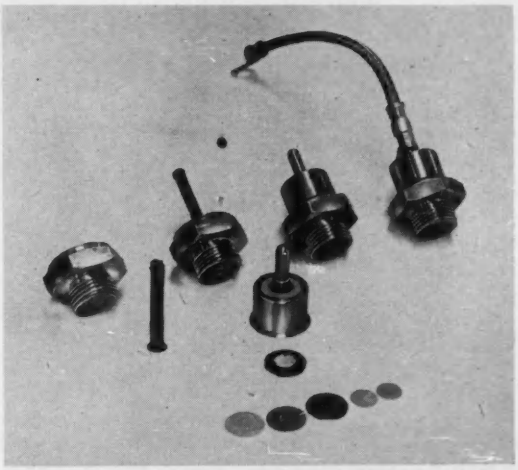
It is fairly well known that the successful manufacture of semi-conductor rectifiers depends very largely on the availability of exceptionally pure raw materials. Freedom from impurities beyond the limits of detection of conventional chemical analysis or refinement is commonplace, and has led to the development of entirely new production methods.

In the case of silicon the problem of purity hinges on the fact that boron is a principal naturally occurring impurity, which because of its poor segregation coefficient in molten silicon is not removed by the well-known zone refining technique which has proved so useful in the case of hyper-pure germanium. In view of this, workers at Standard Telecommunications Laboratories, Ltd., Enfield, the central research laboratories of S.T.C., instituted a programme of research several years ago to find an intrinsically "boron-free" method of making silicon metal. As a result of the success of this work a process plant has been installed at Harlow which produces silicon of possibly the highest purity obtainable anywhere in the world to-day. In addition, the plant provides for completely self-supporting activity in the manufacture of silicon devices and hence freedom from imported supplies.

A measure of the success of this work lies in the fact that the Du Pont organisation in the United States has recently negotiated a licence with S.T.C. to secure the manufacture and exploitation in North America of this exclusive method. The process itself depends on the thermal "cracking" of silane gas into its component parts, silicone and hydrogen. The gas itself and the method of evolution has certain hazards, and the plant, together with control laboratories, is accommodated in a specially constructed single-storey building separate from the main factory block.

All services are run via underfloor ducting and a local warm air filter unit is provided. As there are no windows in the building a battery-boosted standby emergency lighting installation is an essential provision. Associated with the process plant there is a control laboratory specially equipped for trace chemical analysis and physical measurements in connection with the detailed supervision of product quality. Impurity assessment of the silicon itself is carried out by measurements of the principal parameters of resistivity, carrier lifetime and Hall constant.

In the production of silicon crystals equipment designed and built by the Rectifier Division is employed for pulling single crystals of silicon from the melt, i.e. the so-called Czochralski method. The apparatus has been evolved to permit operation by unskilled or semi-skilled operators without detailed



This display shows the build-up of parts of a 100 A silicone diode

Electrolytic etching of germanium photo-cell elements is carried out under the exhaust hood. The jigs enable the sensitive element only to be immersed in the solution

Below: General view of assembly room for ½ and 1 A silicone diodes

Encapsulation of germanium photo-cells in a nitrogen-filled dry box, using an r.f. heating source

supervision. Close attention has to be paid to growth orientation and lattice imperfections and control studies by the laboratories using etch pit counts and X-ray crystallography are carried out on a sample basis. Doping to produce "n" or "p" conductivity types takes place while growing the crystal.

Cutting the crystals to the ultimately used pieces or dice is carried out by what are now conventional methods using diamond and rubber bonded carborundum wheels. The slices of silicon are carefully lapped to the required thickness (usually about 0·012in depending upon the device) and this operation is followed by clean-up etches to eliminate strains and impurities caused by the cutting operations. Intermediate measurements are also carried out to classify the silicon in terms of resistivity in order to regulate the peak inverse voltage of the resulting devices.

The advent of hyper-pure silicon with an extremely low boron content has highlighted the fact that the conventional crystal pulling methods rely on the use of silica crucibles in which the silicon is melted. Unfortunately, erosion of the crucible takes place at these temperatures (1,400 deg C) and unwanted contamination from the silica or from the heater elements involved (usually graphite) can easily occur. In order to preserve the purity level, therefore, some means of avoiding these difficulties must be found. A solution has been worked out at Standard Telecommunications Laboratories and apparatus capable of growing uncontaminated single silicon crystals without the use of a crucible forms an important part of the present installation.

As would be expected with products of the type made at Harlow, careful attention is paid to inspection. Rigorous specifications are followed which call for routine tests on every rectifier diode produced both at room temperature and the maximum quoted ambient temperature (100 deg C). For the larger diodes, besides the conventional d.c. characteristic measurements, tests under full dynamic load conditions and with overload surges are made. Severe environmental tests are carried out on a sampling basis, together with shock, vibration, and endurance runs. All these tests ensure conformity with the armed services specifications.

Equipment has been developed to simplify routine testing and amongst other things this permits the automatic display of device quality for selection purposes. As a further aid to the control of quality, samples of finished devices are regularly taken for sectioning. After mounting and polishing, these sections are studied under a high power microscope to check for junction formation and any irregularities in structure.

Television Recording

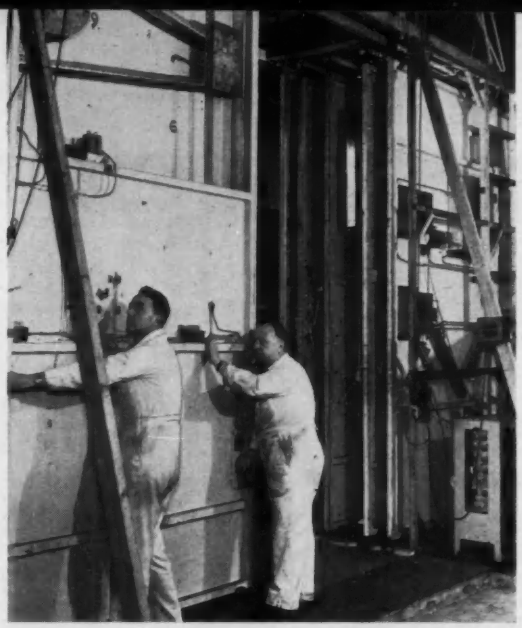
A LECTURE on television recording was given to the Radio and Telecommunication Section of the I.E.E. on 19th November by Mr. J. Redmond, who surveyed the problems involved and the methods currently in use. A successful recording, he said, was one indistinguishable from the original picture. To achieve this it was necessary to keep to the minimum losses in sharpness or resolution and changes in the tonal values or contrast range. Until recently the only way in which television signals could be recorded was on motion-picture film, and the aim was to achieve a teleciné output picture having the same resolution, signal/noise ratio and tonal gradation as the original. With 35-mm film using suppressed field or Mechau equipment it had been impossible to achieve satisfactory signal/noise ratios together with adequate resolutions, but more recently stored-field and fast-pulldown systems had largely overcome this difficulty. With 16-mm film the main limitation was the inadequate resolving powers of existing teleciné equipment. The position of film recording today was that very faithful recordings could be made of television pictures, which could be still further improved by attention to the elimination of flare, which was the biggest single problem which remained.

Magnetic tape recorders had been in common use in sound broadcasting since the end of the war and, in view of their many advantages, a great deal of development work had been going on to enable them to be used for television. Within the last few months successful machines had been put into service in this country. They already showed every promise of making recordings indistinguishable from the original scene. The tape could be replayed at once without processing and re-used many times. The main disadvantage was that the synchronising signals were recorded with the picture, and this caused difficulties in editing, in mixing with other programme sources and in replaying the recording on transmission standards differing from those of the originating country.

The most serious difficulty in magnetic telerecording was that of television standards. Magnetic recordings were waveform recordings; they included the synchronising signal and therefore could not be transmitted by a television station employing a different standard. This meant that the B.B.C. could exchange tape recordings only with the commercial television companies. The difficulty could be overcome in various ways; recordings could be made on tape and the standards converted by a television camera used as a standards convertor, for instance.

In deciding whether to record on tape or film, cost and quality were the main factors. Magnetic tape recordings were of such high quality that programmes could be re-recorded from tape to film with very little loss. Most programmes were likely to be recorded on tape originally, but if a programme required considerable editing or had archival value it could be transferred to film.

The most elaborately illustrated Faraday Lecture in the annual series to date was given by Dr. H. A. Thomas at Swansea on 25th November. The theme of the lecture, which will be given in London on 26th January at the Royal Festival Hall, is concerned with the meaning of automation. Dr. Thomas defines automation as " the displacement of some of man's mental effort by machines "



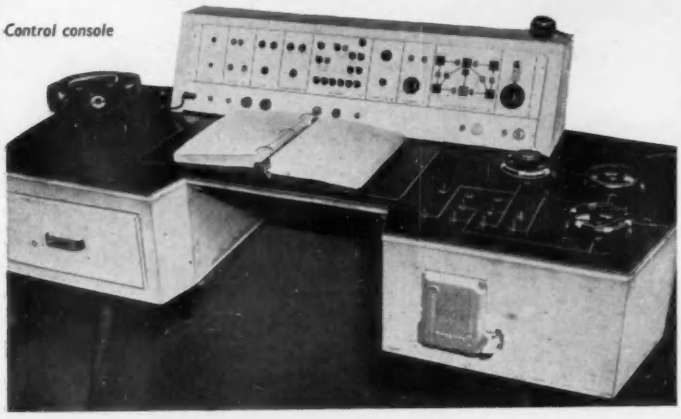
Moving a demonstration panel into position: a view behind the scenes

AUTOMATION OR THE SECOND INDUSTRIAL REVOLUTION

FARADAY LECTURE

THERE are many definitions of the word "automation": Dr. H. A. Thomas (Unilever, Ltd.) has endeavoured in his Faraday Lecture to explain, with the aid of many working models, slides, and films, what he considers to be its true meaning. Although the lecture, which is sponsored by the Institution of Electrical Engineers, has a popular appeal, a broad survey of electrical instrumentation and control systems is given which makes it suitable for more specialised audiences.

Dr. Thomas has gone to extra lengths to provide numerous working models and demonstration apparatus to illustrate his lecture. These models have all been designed and constructed by the Instrumentation and Control Section of the Engineering Department of Unilever, Ltd. Production commenced last year in part of John Knight's factory, additional assistance being provided by the staff of John Knight, Ltd., and, during the past six months, by the staff of Elliott Bros. (London), Ltd. The G.E.C. has lent the lighting fittings and has supplied over a thousand " Osram " lamps, while I.C.I. and Courtaulds have provided paints, plastics and fabrics.



Control console

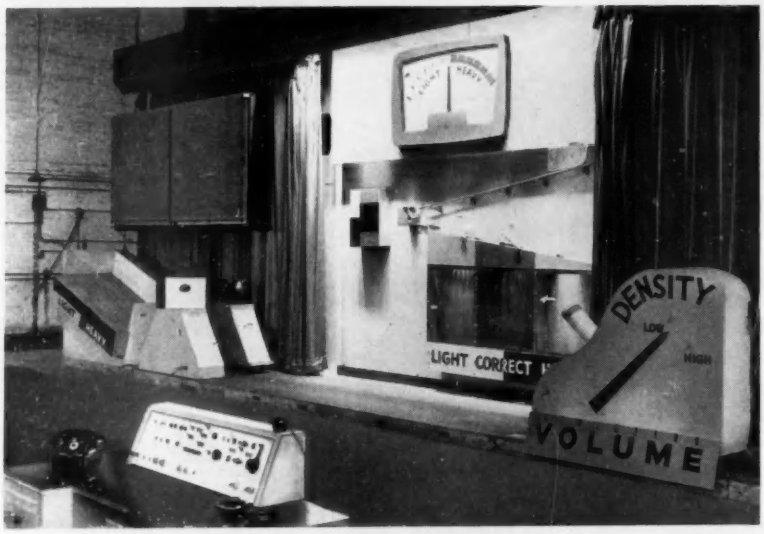
Dr. Thomas defines automation as " the displacement of some of man's mental effort by machines " and states that this new technique is only just beginning: he pleads for a greater national effort in the development of more extensive automatic control systems to improve productivity and hence the standard of living.

The lecture begins with a description of production methods from the craft stage through the hand tool stage to the machine stage. The first industrial revolution brought power to aid man's physical strength while the second industrial revolution now taking place concerns devices to aid man's mental power.

The difference between batch and continuous processes is illustrated by filmed examples from the oil and steel industries. The introduction of instruments is illustrated by films and a working model of a " brightness indicator." The difficulty of controlling a continuous process by human operation is illustrated by a working model of level control of liquid in a tank. Instruments and various types of control systems are described and a distinction made between an on-off controller, such as a thermostat, and a continuous-measurement automatic controller.

Production processes in engineering industries are then sectionalised into the five operations of making, inspecting, assembling, testing, and packaging. Development in each of these operations is shown by filmed examples. Improvements in the transfer of the product between machines and the automatic sequencing of machine tool operations is shown. But these mechanical engineering developments are not automation in the sense used by Dr. Thomas in his lecture.

There is still a vast amount of work being done by human beings in the second operation of the production processes, inspection. The use of electronic devices to replace human



Automatic weighing demonstration

observation in the tedious tasks of inspection are illustrated by filmed examples and a working model of an automatic gauging plant. This model shows discs of slightly varying diameters being rotated under, and gauged by, an electronic sensing element. According to the output the discs are diverted into one of four bins according to size; the size of the discs is also registered on a large meter on the front of the demonstration panel; when an oval disc is passed through the apparatus the indicator hunts and the disc is rejected. With greater mechanisation, assembly work is being divided into smaller operations so that one man performs one minor operation only. Much of this dull work is now being eliminated by automatic assembly equipment; this is illustrated by a film showing the assembly of electronic panels with automatic soldering of connections to printed circuits.

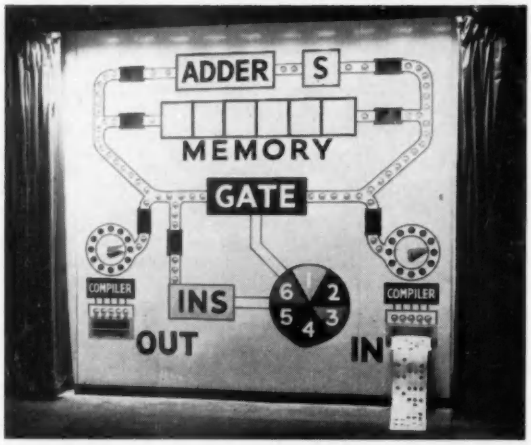
Testing is illustrated by film; one example shown is the testing and grading of radio valves according to their electrical performance.

Packaging processes by hand and by machine are also shown on film, and counting and batching is illustrated by a working model; in this demonstration, discs of various colours are sorted and counted by photo-electric control.

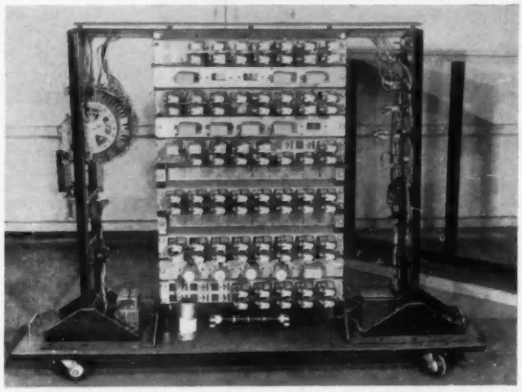
The lecturer then summarises the main types of human effort involved in industrial production; it is shown that by mechanisation, man's physical effort has been aided by devices of all kinds and that, in consequence, productivity has been increased enormously. Electronic devices supplement man's senses and a better quality product has been obtained with relief from boredom associated with repetitive employment of his faculties. There is still, however, a vast amount of work undertaken by human beings which could be done far better by machines: this is where true automation begins — the displacement of some of man's mental effort by machines.

Control of production processes by human beings involves sampling, measurement, calculation and decision taking. The lecturer then discusses machines which can relieve man of some of these tedious mental efforts. The first illustration of true automation is a working model of automatic weight control. A machine makes dough balls; the dough balls are weighed electronically and roll down into three bins according to their weight; a dial indicates whether individual dough balls are light or heavy. To simulate the electronic weighing of the dough balls, tennis balls are shot from a gun on one side of the stage into a weighing basket at the other side of the stage. The point at which each tennis ball strikes the basket is an indication of the weight of the corresponding dough ball; if light, the indicator shows the deviation from the average and the dough ball is deposited into the corresponding bin. If too many consecutive balls are light, indicating a density trend, the machine simulates the required correction by automatically moving the gun farther away from the basket. It is shown that this machine can make decisions and act on them.

The introduction of machines to relieve man of tedious



Left : Computer demonstration panel. Below: Control apparatus for computer panel



mental effort is next illustrated by studying a typical procedure of human beings undertaking clerical calculations. With 2½ million clerical workers (11 per cent of the working population), we are fast becoming a nation of clerks. The author then discusses the similarity of clerical work with the operation of an electronic computer and illustrates this by a film. The history of the digital computer is briefly reviewed.

Because of the similarity between the operation of an electronic computer and human thought processes such machines are often called "brains." The lecturer makes it quite clear that such machines are only "very fast morons," but, if programmed by very clever people, can be made to do remarkable things.

Computers operate on the binary system, which is demonstrated and explained by a working model, a demonstration of binary addition and several animated films.

The application of electronic computers to scientific problems is illustrated by films of aircraft control and weather forecasting and the application to the control of machine tools by further films showing the procedure from the drawing board to the finished product.

The way in which information from sensing elements can be converted into a form suitable for introduction into a computer is illustrated by an animated film and two working models.

The use of computers in decision taking is illustrated by an entirely new film specially prepared by Unilever, Ltd., for the lecture. This film, entitled "The Electronic Computer in Commerce" and made by Rayant Pictures, Ltd., shows their utility in business administration. Examples of the use of computers include the assessment of different manufacturing possibilities to enable management to make decisions regarding the best methods of production from an economic aspect; comparison between the mechanised office with desk calculators and an office using an electronic computer; and the working out of the economic size and the best place to build a factory with regard to sources of raw materials, labour, consumer demand and distance to port facilities. With the advent of computers into clerical work a vast paper-work revolution is taking place.

Finally, the automatic factory of the future is demonstrated by a large working model and the lecture concludes with a comparison of the national effort being put into these developments by Russia, America and Great Britain.

An Electrical Centenary

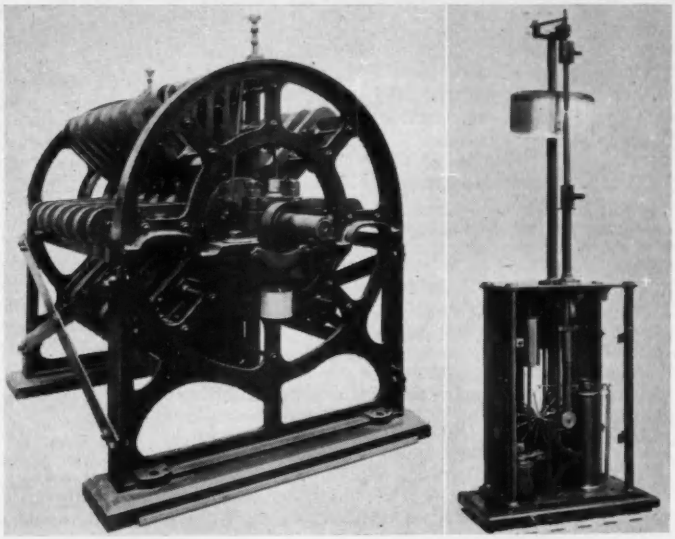
Early Experiments at South Foreland Lighthouse

By W. T. O'DEA, B.Sc., M.I.E.E.*

AN important electrical centenary falls on 8th December, although it is open to doubt whether it is proper to accept it, as some say, as the centenary of the electricity supply industry. The foundation for this claim seems to be the suggestion that the houses of keepers at the South Foreland lighthouse may have been supplied with electricity at the same time as a supply was undoubtedly fed, from a Holmes magneto-electric machine, to an experimental arc lamp installation. If such a supply were given I cannot imagine what it was for. There were no filament lamps, no cookers, no fires and no motors to demand it. There must have been a considerable distance between the generator and its single arc lamp load, but even the lamp itself did not pass out of the experimental stage until 6th June, 1862.

Nevertheless there is every reason to regard 8th December, 1858, as a red-letter day in the history of the application of electric power to practical ends. At first the electric generator was a toy which was supposed to administer mildly therapeutic shocks, for which exaggerated medical benefits were claimed. Then, in 1844, Woolrich in Birmingham built a compound magnet machine for the electroplating works of Messrs. Prime of the same town. This was the first serious industrial application. Two years later the arc light was used on the stage at the Paris Opera, but fed by batteries of Bunsen cells; and as early as 1841-44, in Paris there had been similar attempts at street lighting.

Holmes permanent magnet generator of 1867, similar to those used at South Foreland and (right) original Holmes arc lamp. (Reproduced by courtesy of the Science Museum)



* Keeper, Science Museum, South Kensington.

All these, together with street lighting demonstrations from 1849 onwards in Britain, were anything but permanent installations.

Meanwhile the growth of sea trade during the industrial revolution had emphasised the inadequacy of the lights shown around the coasts of Britain, particularly in bad weather. Trinity House and the Commissioners for the Northern Lighthouses had been concerned with this problem ever since the Argand oil lamp of 1782-84 seemed to offer advantages over the 24 tallow candles, for instance, that were exposed at Eddystone, or the coal fire that continued as late as 1816 at the Isle of May in Scotland.

The consultant on these matters for Trinity House was Professor Michael Faraday and it may be news to those who think of him only in terms of his electrical work to hear that one of his most important practical suggestions was for an articulated chimney to conduct the products of combustion out of the lanterns containing oil lamps without subjecting them to the danger of being extinguished by down draught. Twenty pints of oil on a winter's night made more than its equivalent volume of water vapour which turned to ice on the windows of the lantern. Professor Faraday's suggestion of 1843 let the water vapour get away and left the panes clear. In 1839 he was experimenting with an oxygen-fed oil lamp flame, but it proved too expensive. In 1862 the Drummond, or lime light, was being tried, but by that time the electric arc gave greater promise. Nevertheless it was from the unsuccessful Nollet machine, from which it was hoped to get cheap oxygen and hydrogen for the lime light by the decomposition of water, that Holmes, in 1857, developed his generator used in trials of the electric arc.

The first trials took place at Blackwall in 1857, to the delight of Professor Faraday under whose direction they were made. The machine weighed two tons and absorbed about 2½ h.p. Two more, but slower, machines were quickly built for a real sea trial at the South Foreland upper lighthouse. These weighed 5¼ tons and were driven at 90 r.p.m. by a non-condensing engine acting directly on the axle of the machine. The power absorbed by each machine was 2¾ h.p. The arc lamp was of the type devised by Duboscq, but in a letter from Holmes dated 1881 in the Science Museum files (his own spelling):—

> "When these lamps were made I had to calculate that those who would have charge of them were principally old saylors and therefore constructed the working parts of the lamp not with clockwork but with a windlass and pullies—things well understood by them."

He claimed that his first lamp "was working every night for, I believe, 19 years and was never repaired." To quote Sir James Douglass in his paper of 25th March, 1879, to the Institution of Civil Engineers on "The Electric Light Applied to Lighthouse Illumination":—

> "On the 8th of December, 1858, the electric light, produced by permanent magnets, was shown on the sea, for the first time, from the South Foreland high lighthouse."

Douglass goes on to quote Professor Faraday's report:

> "I beg to state that, in my opinion, Professor Holmes has practically established the fitness and efficiency of the magneto-electric light for lighthouse purposes. . . . The light produced is powerful beyond any other that I have yet seen so applied, and in principle may be accumulated to any degree; its regularity in the lantern is great, its management easy, and its care there may be confided to attentive keepers of the ordinary degree of intellect and knowledge."

Experiments continued at the South Foreland until 1862 by which time, after some modifications, the Holmes system was regarded as good enough for normal and continuous working every night. There seems little doubt that 8th December, 1858, saw the start of the first permanent installation for electric lighting, just as the year 1844 saw the first substantial project for using electrically generated power for electroplating. The electric motor load came much later. Edison envisaged such a load when he built the power station at Pearl Street, New York City, in 1881-82, but it was several years before any results were recorded. Lighting, for many years after 1858, was the chief spur to electrical developments and accordingly we can be grateful for the pioneering work of Professor Holmes, which did so much to draw attention to the desirability of improving the electric generator and providing electric supplies.

Mines and Quarries

THE report of H.M. Chief Inspector of Mines and Quarries for 1957, the first to be issued under the Act of 1954, now includes electrical matters formerly dealt with by H.M. Principal Electrical Inspector. At the year end 1,435 coal mines were working, of which 905 were operated by the National Coal Board and 530 under its licence. Out of 395 fatal accidents in coal mines from all causes, three were due to electric shock and four to electrical ignition of fire-damp or coal dust—all seven are ascribed to misuse, negligence or ignorance; switchgear and fuses were involved in three cases. Of a total of 1,918 non-fatal accidents 71 were due directly or indirectly to the use of electricity; misuse, etc., again headed the list of causes (52). Switchgear and fuses were involved in 43 incidents, cables and wires in 12 and armoured cables or accessories in ten. Eight cases of shock or burns resulted from testing the operation of a gate-end switch by earthing the pilot pin in the outgoing circuit with a piece of wire and a rectifier. The Ministry has now certified, as a flameproof unit, a remote-control circuit test plug. One manufacturer provides an additional position on the isolator within a gate-end switch which allows that part of the control circuit within the gate-end box to be tested without making the socket alive. Numerous shocks and/or burns were received by electricians through neglecting to have circuits isolated and discharged to earth before working on them or through restoration of power prematurely.

Faulty maintenance contributed to an accident in which an electrician received burns during examination of an 11 kV truck switch. The busbar section switch had not been fully opened owing to an operating rod coated with rust failing to pass through a tight bushing; it should have been isolated also. In view of accidents, sometimes fatal, through cranes coming in contact with overhead lines, these lines should be replaced by underground cables wherever possible on colliery premises.

Copies of the report are obtainable from H.M. Stationery Office, price 5s.

Acoustic Waves

THE forty-fifth Thomas Hawksley Lecture was delivered on 21st November to the Institution of Mechanical Engineers by Dr. Leo L. Beranek (Massachusetts Institute of Technology), who took as his subject the transmission and radiation of acoustic waves at audible frequencies by structures. Formulæ, charts and tables for determining the transmission loss of single and double walls were presented with data on the transmission of bending waves round corners. It was shown that through the use of damping materials a structure-borne wave could be attenuated in a given distance by a factor of 10 or more than when utilised in a conventional manner.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Building Construction and Space Heating

I REGRET that I have only just seen Mr. Ellarby's reply in your issue of 7th November to my letter, and apologise for commenting at so late a date. I am sorry he thinks me inaccurate and in need of correction, but the facts are as I stated.

Hollow clay facing blocks have been made and marketed by the London Brick Co., makers of Fletton bricks (with an output of around 40 per cent of the country's total), for the last 25 years: the three-celled form was introduced first, but was replaced by the six-celled block, identical with Mr. Ellarby's illustration, about seven years ago. They are all grooved for plastering (being extensively used for partitions) and rendering and the London Brick Co. tell me that they should be rendered externally, and their published data gives " U " values for external walls on this assumption. I have discussed the matter with several colleagues and found that none of us was aware of, or would for one moment recommend their external use unrendered. Even on the Continent where the use of larger hollow clay blocks has been standard practice for many years, rendering is always carried out, even in the more favourable climatic areas.

Mr. Ellarby's statement that " hollow clay facing blocks are available, and so . . . rendering is not essential," is such a wild *non sequitur* that I cannot believe he really means it: the availability of a product has nothing whatever to do with how it can be used. I am informed that the makers of the blocks to which he refers have recently completed a laboratory and measured their thermal characteristics, but that the results have not been confirmed by an independent authority.

Comfort in a house is not only a matter of " U " values: these are based on laboratory tests in the " steady state " which does not, in fact, obtain for a sufficient length of time under domestic conditions to be valid for more than approximate use. As an architect I am concerned (in this context) with so-called comfort conditions, and that is why I expressed the hope that Mr. Ellarby would keep careful records, and I am glad he is doing so; those obtained from larger buildings in recent years indicate that present theory does not seem to account for all the recorded facts.

London, N.W.11. A. L. OSBORNE.

Breakdown of Electrical Equipment

THE very interesting article by Mr. F. E. Noakes, in your issue of 7th November, contains two excellent illustrations of motor damage due to bearing failure, Figs. 7 and 8, and suggests that regular checks of the air-gap length should be made to enable slack bearings to be detected and replaced before such damage can occur.

Routine site checks of this nature have many disadvantages, not the least being unreliability. It is quite possible for bearing failure to occur within hours of any initial abnormal increase in diametral clearance, with the results shown by Mr. Noakes. Such damage is entirely due to the rotor fouling the stator for some time before being stopped.

Such incidents can be entirely prevented by means of " Gap-Protection," a device which has recently been developed and marketed by Anstee & Ware, Ltd., St. Andrews Road, Avonmouth. This device continuously monitors, and gives a remote indication of, the air-gap length of the motor during actual operation. It will also give warning, or shut down the motor should the air-gap eccentricity exceed a predetermined amount, whatever the cause.

Bristol. R. I. ELLARBY, A.M.I.E.E.

Steel Analysis Spectrographs

YOUR issue of 14th November has an interesting article on "Electronics in the Steelworks," by Mr. J. K. Edwards, of the Steel Company of Wales. In it, Mr. Edwards describes an American automatic spectrograph (the " Quantometer ") which, in principle, resembles our own grating polychromator and is used for the same purpose—analysing steel and other metals and substances.

Mr. Edwards refers to the difficulty of separating the spectrum lines of carbon and sulphur and says that it is hoped to solve the problem by new vacuum techniques. This is surprising for two reasons. First, vacuum techniques are by now very well established. We made our first vacuum spectrograph in 1919, and it and many others made since have been largely used for analysing non-metals. Secondly, and more particularly, the Steel Company of Wales themselves have one of our fluorite polychromators, these being automatic spectrographs developed in the last few years for the express purpose of determining carbon, sulphur and phosphorus in steel. Admittedly, these instruments use fluorite prisms instead of gratings, but their fundamental principle is identical with that of grating instruments—the analysis of materials by examining the spectra they emit when electrically arced or sparked.

The Steel Company of Wales are, as we have good reason to believe, very well satisfied with the performance of their instrument. Hence our surprise at Mr. Edwards' neglecting to mention it.

London, N.W.1. W. BAMFORD,
General Sales Manager,
Hilger & Watts, Ltd.

Unsightly Lights ?

I HAVE recently returned to India after spending some months on leave in the United Kingdom and during the time that I was there I noticed in all the big cities the most unsightly erections carrying the floodlights for the various association football grounds and I was interested to see the article in your issue of 10th October where you describe the Blackpool floodlighting.

Has no protest been made at all in England regarding these unsightly erections, as they can be seen for many miles around and surely must be considered as far from beautiful. You yourself, I notice, did not give any comment on the appearance of them in your article.

Calcutta. F. N. PRANGNELL.

Electrical Power Engineers' Dinner

THE Electrical Power Engineers' Association held its thirty-first annual dinner at the Connaught Rooms, London, on 28th November, under the chairmanship of its president, Mr. C. Donnellan. After the loyal toast had been proposed by the chairman, the Minister of Power, Lord Mills, proposed a toast to the Association. Referring to the happy relationship between his ministry and the electricity supply industry, for the professional technical staff of which the Association is the representative organisation, Lord Mills spoke of the importance of electricity and the way in which it had revolutionised home life. Industrial development also meant a greater use of electricity. " It is evident," he said, "that if people are to enjoy high living standards, if our industry is to expand and become more efficient and we are to retain an authoritative position in world trade, we must be supplied with abundant and cheap power."

Speaking of the progress made by our scientists and engineers in nuclear engineering he said that not only our country would benefit. The laying last week of the foundation stone at Latina, Italy, marked the start on the biggest civil nuclear station to be erected in continental Europe, which was the first overseas order obtained by one of this country's nuclear power groups.

The provision of the generating capacity and the transmission and distribution system in our country, requiring the investment of over £1,000 million every four years, represented a heavy call on the country's capital, material and labour resources, and it was essential to ensure that these resources were profitably and efficiently employed. Lord Mills went on to speak of the difficulties in siting plant and equipment and said that those responsible should endeavour to meet the interests of those keen on preserving amenities. The increasing demand for electricity and the bigger boilers, larger generating sets and nuclear stations needed to meet this demand would call for even more skill in operation and research. The roles of the engineer and technician in the industry would be as important as those in any great industry in the world.

In his reply the chairman, after welcoming the distinguished guests, referred to the immensity of the industry's task. The days of load curtailment were past and he said that the task now was to use the equipment available at its maximum efficiency, employing the results obtained by operational research. He then thanked Mr. F. H. Smethurst for organising the dinner, which ended with the customary dance.

(Left to right): **1.** *Mrs. D. B. Irving, Mr. D. B. Irving (chairman, London Electricity Board), Mr. C. T. Melling (member, Electricity Council), Mrs. C. T. Melling, Mr. S. S. Scott (chief personnel officer, C.E.G.B.) and Mrs. R. A. Finn.* **2.** *Lady Hinton, Sir Christopher Hinton (chairman, C.E.G.B.), Mrs. E. S. Booth and Mr. E. S. Booth (chief design and construction engineer, C.E.G.B.).* **3.** *Lady Mills, Mr. C. Donnellan (president, E.P.E.A.), Mrs. C. Donnellan, Lord Mills (Minister of Power), Sir Henry Self (chairman, Electricity Council) and Mr. A. R. Cooper (member, C.E.G.B. and regional director, Eastern, London and South Eastern Region, C.E.G.B.).* **4.** *Mr. L. Benallick (immediate past-president, E.P.E.A.), Mrs. L. Benallick, Mrs. R. Johnson, Mr. R. Johnson (president-elect, E.P.E.A.), Mrs. A. M. F. Palmer and Mr. A. M. F. Palmer, M.P.* **5.** *Sir Josiah Eccles (deputy chairman, Electricity Council), Mrs. H. J. Frazer, Mr. I. C. Williams (national treasurer, E.P.E.A.), Mrs. I. C. Williams and Mr. H. J. Frazer (vice-president, E.P.E.A.).* **6.** *Mr. H. J. Bennett (controller, London Division, C.E.G.B.) and Mrs. Bennett.*
7. *Mr. D. G. Dodds (industrial relations adviser, Electricity Council), Mrs. D. G. Dodds, Mrs. P. S. Watson and Mr. P. S. Watson*

VIEWS on the NEWS

By REFLECTOR

IN spite of the increasing demand from electric power stations, there is still a superfluity of small coal. The point was raised at a recent inquiry into an application by a company for permission to work open-cast coal in an area of South Derbyshire. This, it was said, would be coal of household quality which was scarce and would find a ready sale. The applicants' secretary, when reminded that there were large stocks of small coal, suggested that this would have to be buried. It reminds me of the old remedy for unemployment: digging holes and filling them in again. A miners' representative at the inquiry said that the suggestion was "extremely serious because of the psychological effect it would have on the men in the industry." It certainly would be rather frustrating.

* * *

Hole-filling was also the theme of a letter to the *Manchester Guardian* from the county planning officer of Derbyshire, Mr. M. J. Hellier. In this case it was the restoration of gravel pits. Mr. Hellier relates this to the need for the Central Electricity Generating Board to dispose of the enormous output from its power stations of pulverised fuel ash. He suggests that the Ministries interested in this subject should get together to work out a general agreement on the appropriate means and cost of transportation, and the provision of sufficient top soil to bring the restored areas back into cultivation. This is probably a good idea—if the Generating Board is not disposing of the bulk of its ash to producers of building aggregates. Some time ago I noted a scheme for filling in underground chalk workings with power station ash but I have seen nothing about it lately.

* * *

A correspondent signing himself "Householder" complains in the *Manchester Evening News* that the Electricity Board wants £200 to run a cable to the house in which he lives but which he does not own, although the Board "admits a profit of £40M." Moreover, he says:—

> "On a recent visit to Partington power station I was informed that they had too much electricity and were going to export it to Germany."

* * *

Popular newspapers make much of "electronic brains" and are sometimes disposed to attribute to them the human power of original thought. Last week there was an international symposium on the mechanisation of thought processes—a title which seemed to lend colour to the newspapers' suggestion. Nevertheless the speakers in the symposium deprecated the crediting of computers with intelligence. One of them, Dr. D. M. Mackay (King's College, London) said that every branch of science had its "honest hodmen" who excelled in a technique and could produce valuable results from its careful and persevering application. A conventional computer could be the honest hodman *par excellence*, but for all its dexterity and reliability

> "it is not bright: it is indeed desperately less bright than the dullest human hodman, for even he permits himself an occasional spontaneity when off duty. It is humanly impossible to be as dull as a digital computer."

* * *

It is a regular custom to present people who inaugurate new works and buildings with a souvenir of the occasion and nobody thinks any the less of the givers and receivers. Last week the Lord Mayor of Nottingham opened a new electricity service centre in the city and his wife was presented with a refrigerator. Later, however, he sent a cheque for the value of the refrigerator (£100) to the East Midlands Electricity Board. I suppose that a rather expensive refrigerator could be considered an excessive form of souvenir and I appreciate the Lord Mayor's action. But apparently it was not so much the amount as the principle for, according to *The Times*, the Lord Mayor said:—"If the presentation had been from a private firm, I would have accepted it. But I could not accept it from a nationalised industry." This seems to me to be a somewhat fine distinction.

* * *

The issue of the *Electrical Review* of 1st December, 1878, contained many references to the nascent electric lighting industry. The leader writer of the day, dealing with the position of the gas companies, wrote "We must wait to see what Mr. Edison is ready to do before we can predict the turn of affairs." Tucked away in this issue I came across an amusing little fable concerning a colony of glow-worms who "waxed fat on the taxes they levied for their light." It went on

> "But as they waxed fat, they found it more and more trouble to keep their tail-lights bright; nor did they wish to, for they were paid whether their lights were good or bad, and if a poor grub complained that he could hardly see to dig, they would straightway cut off his light altogether. . . . Things were in this state when, one fine day, a gad-fly, an arrant gossip, and post-boy to the grove, suddenly brought the news that the 'Great American Lighting Bug' was coming. The effect was indeed electrical—one half of the frightened glow-worms scampered off as fast as their legs would carry them, and the other half turned over on their backs and grew sick. But time passed and the Lighting Bug did not appear, so the glow-worms gradually took heart again and those that had run away came back, while those that had turned ill recovered their dignity, and all of them boasted as before. The gad-fly was denounced as a rogue, and the Lighting Bug was proved to be only a large Hum Bug, but for all that the fire-flies continue to arrive faster than ever, and the gad-fly swears that the Lighting Bug is on his way."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Power has accepted the resignation of **Mr. G. C. R. Eley** from part-time membership of the London Electricity Board. Mr. Eley has resigned following his appointment as an additional deputy chairman of Richard Thomas & Baldwins, Ltd.

Mr. L. Ingham, A.M.I.E.E., formerly manager of the industrial sales division, has been appointed assistant sales manager of Chloride Batteries, Ltd., for the sales of all types of batteries in the United Kingdom and overseas. On leaving school Mr. Ingham enrolled for one of the first training courses organised by the Chloride Electrical Storage Co. After two years' training he joined the Works Engineer's Department, but left Chloride two years later to join the Metropolitan-Vickers Electrical Co., Ltd., where he was engaged on switchgear and motor control design. He later joined the staff of the Lancashire Electric Power Co. and after service in the Royal Navy in the last war, in which he attained the rank of lieutenant-commander, he rejoined that company. He was subsequently manager of the electrical side of an electrical contracting company for two years before returning in 1948 to Chloride Batteries, Ltd., to develop the traction sales division.

Mr. L. Ingham

It is announced that the board of the newly formed company, Birlec-Efco (Melting), Ltd., comprises **Mr. G. P. Tinker** (chairman), **Mr. J. C. Howard** (managing director), **Mr. F. S. Leigh** (assistant managing director) and **Messrs. D. L. Campbell, J. H. Crossley, P. F. Hancock, J. A. Monks** and **T. G. Tanner.** The secretary is **Mr. J. C. Mantell.** The company has been formed by Birlec, Ltd., and Efco, Ltd., for the design and supply of all types of electric melting furnaces, including vacuum melting furnaces, for the ferrous and non-ferrous metals industries, as well as smelting furnaces and induction heating equipment. Its offices are at Westgate, Aldridge, Staffs.

Mr. G. P. Tinker

Mr. J. C. Howard

Mr. F. S. Leigh

Mr. G. O. James, A.M.I.E.E., A.M.B.I.M., who for the past four years has been district labour relations officer for London, has been appointed secretary to the Boards' side of the National Joint Industrial Council for the Electricity Supply Industry, and a labour relations officer in the Industrial Relations Department of the Electricity Council.

After studying electrical engineering at Swansea Technical College, Mr. James, in 1925, entered the service of the Swansea Corporation Electricity Department, in which he was distribution engineer at the time of nationalisation in 1948. In that year he was appointed by the Central Electricity Authority to be district labour relations officer in the Southern District and moved to London in 1954.

Lt.-Col. J. P. Flowerdew has been appointed production manager, Servomex Controls, Ltd., of Crowborough, Sussex. He gained first-class honours in mechanical sciences at Cambridge and later had experience in armament design during his Army career. In his new appointment he will be directly in charge of all production facilities at Servomex and will later take over responsibility for the production engineering and final design of the equipment.

Lt.-Col. J. P. Flowerdew

Dr. J. G. Pearce, C.B.E., M.I.Mech.E., M.I.E.E., F.I.M., F.Inst.P., the director of the British Cast Iron Research Association, is retiring from office at the end of this year. He has held the post of director since 1924.

Dr. Pearce was earlier associated with Sir Arthur Fleming in the planning and organisation of the Research and Education Department of the Metropolitan-Vickers Electrical Co., Ltd., Manchester, and he was co-author with Sir Arthur of two textbooks on apprentice training and research in industry. He has served on numerous national and international committees: since 1935 he has been chairman of the Main Committee on Cast Iron of the British Standards Institution, and he is chairman of the appropriate cast iron committee of the International Standards Organisation, which had its first meeting in London in 1955. A dinner to mark his retirement will be given to Dr. Pearce at the Connaught Rooms, London, W.C.2, on 15th December.

In view of Dr. Pearce's retirement, the Council of the Association has made the following appointments from

Dr. J. G. Pearce

Mr. H. Morrogh

1st January next:—**Mr. H. Morrogh,** now deputy director, to be director; **Dr. H. T. Angus,** now assistant director, to be deputy director. **Mr. T. E. Whiteside,** A.C.A., will continue as secretary with special duties with respect to the Association's finances.

Fielden Electronics, Ltd., has formed three new sales divisions—London, the North-East and the Midlands. Appointments recently made in these divisions are as follows:—**Mr. R. Speller,** after three years as company representative in London North, becomes manager of the London sales division. **Mr. F. G. Totty,** formerly Yorkshire representative, becomes North-Eastern sales division manager, based on Stockton. **Mr. F. B. Price,** for many years Fielden representative in the Midlands, assumes the management of the Midlands sales division.

Mr. W. B. Sallitt, general manager of the nuclear division of the Superheater Co., Ltd., has been appointed a special director of the company.

Mr. J. Warnock, M.C., M.I.C.E., M.I.Struct.E., hydro-electric engineer for the North West, Merseyside and North Wales Region of the C.E.G.B., retired on 4th December. Educated at Wishaw Secondary School, Mr. Warnock served his apprenticeship in

civil engineering with the Lanarkshire County Council and received further training with Formans & McCall, civil engineers, Glasgow.

He was commissioned in France during the 1914-18 war and after the war he served with the General Electric Co., Ltd., Sir Robert McAlpine & Son, Ltd., and Stewart & McDonnel, and spent a year on construction work on the Gold Coast. After leaving the Gold Coast he joined Messrs. Merz & McLellan, with whom he became the senior resident engineer on the Mid-East England grid scheme; he was also engaged on plant installation for the Galloway water power scheme. In 1934 Mr. Warnock became assistant manager of the Galloway Water Power Co. and was appointed in 1948 to the position he has now relinquished.

Mr. V. L. Clare, at present a lighting engineer with the south-west region of Philips Electrical, Ltd., Bristol, has been appointed area lighting manager for the Bristol branch area as from 1st January next. Mr. Clare has spent the past twenty years in the electrical industry, mainly in Bristol and district. He has a wide experience of the maintenance, contracting and wholesale fields, and has been with Philips since 1953.

Mr. V. L. Clare

The B.B.C. has appointed **Mr. A. J. Pilgrim,** Associate I.E.E., as engineer-in-charge (sound), Birmingham, in succession to **Mr. A. A. Coker,** who has been transferred to a similar appointment in Bristol. Mr. Pilgrim has been assistant area lines engineer, Birmingham, since 1951.

Mr. G. T. Frost, of Hillingdon, Middlesex, has been appointed area sales engineer for William McGeoch & Co., Ltd., Birmingham, in the eastern sector of the London area, in place of Mr. P. Gould, who has resigned. Mr. Frost was previously with the British Electric Transformer Co.

We regret that in the caption to the photograph taken at the recent annual dinner of the I.E.E. Tees-Side Sub-Centre, **Mr. N. C. Lake** was incorrectly referred to as deputy manager of Head, Wrightson & Co., Ltd. Mr. Lake is deputy managing director of the company.

In our last issue we briefly recorded the election of officers of the Electrical Trades' Commercial Travellers' Association for the ensuing year.

Mr. W. J. Bird, who is the new president, has been with the General Electric Co., Ltd., since 1925. He was appointed London sales manager in 1950, deputy sales manager of the company in 1954, and home sales manager in 1956. He was appointed to the board of the company in December last.

Mr. W. J. Bird

Mr. S. E. R. Barker

Mr. S. E. R. Barker, who has been elected chairman of the Association, is also with the G.E.C., and has been manager of the new branch office at Magnet House, Dagenham, Essex, since July this year.

Sixteen members of the Sopwith Apprentices' Association, original apprentices with the Sopwith Aviation Company in 1914, visited the Research Laboratories of the **General Electric Co., Ltd.,** on 28th November, at the invitation of Mr. Frank E. Buckell, aeronautical manager of the G.E.C., himself a member of the Association. The visitors were welcomed by Mr. O. W. Humphreys, O.B.E., research director of the G.E.C., and after touring the laboratories in the morning they visited the Osram Lamp Works, Wembley, in the afternoon. They were accompanied by Group Captain J. J. Jeffs, commandant of London Airport, and Mr. J. C. C. Taylor, secretary of the A. V. Roe Apprentices' Association.

Mr. J. C. Gale has been appointed to the board of Petters, Ltd., a member of the Hawker Siddeley Group.

Mr. K. S. Phillips, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E., has been appointed sales controller of Research & Control Instruments, Ltd. Among other duties he will be responsible for the co-ordination of all sales staff activities. Mr. Phillips was trained as an electronics engineer at the City and Guilds College. He has been sales manager of the industrial valve division of Siemens Edison Swan, Ltd.

Mr. K. S. Phillips

Mr. A. E. Peters, departmental manager of the Electrical and Insulating Department of Spicers, Ltd., retires today (Friday) after thirty-five years with the company.

Recent Metropolitan - Vickers appointments include those of **Mr. R. Crummack,** B.Eng.(Elec.), assistant superintendent, Process and Rate Department; **Mr. R. G. Nicholas,** Graduate I.Mech.E., assistant superintendent, Process and Rate Department (method study); **Mr. J. P. Stockbridge,** assistant superintendent, Motor Department; and **Mr. W. A. Ciclitira,** B.Eng., A.M.I.E.E., assistant sales manager, Motor Department.

Mr. Crummack joined Metropolitan-Vickers in 1950 as a college apprentice. In 1952 he joined the company's Sheffield Works, returning to Trafford Park in 1956 to join the Process and Rate Department as a manufacturing engineer.

Mr. Nicholas also joined Metropolitan-Vickers (in 1949) as a college apprentice. Later he was engaged on precision casting work and then became manufacturing engineer in the Main Tool and Gauge Department and, later, chief method study engineer in the Process and Rate Department.

Mr. Stockbridge joined M.-V. as a school apprentice in 1929. All his subsequent service has been on the manufacturing side of the Motor Department.

Mr. Ciclitira joined the company in 1932 as a probationary college apprentice and after his apprenticeship he joined the Motor Sales Department. He has been concerned with the administrative side of the department for the past ten years.

The first annual dinner of the Wolverhampton and Districts Branch

Mr. K. Ratcliffe speaking at the A.S.E.E. Wolverhampton branch dinner. On his right is Mr. E. A. Bromfield, general secretary, A.S.E.E.

of the **Association of Supervising Electrical Engineers** was held at Pattingham on 28th November. Mr. K. Ratcliffe, chairman of the branch, presided.

Mr. Adrian Davis, elder son of Mr. and Mrs. Cyril H. Davis and the fourth generation of the family to be actively associated with Reliance Cords & Cables, Ltd., was married last week to Miss Dawn Grosswald, of Southport. On their return from honeymoon the couple will be going to Northern Ireland where Mr. Davis will be responsible for the management of Belfast Cables, Ltd.

The annual dinner of the Foremen's Section of the **Telegraph Construction & Maintenance Co., Ltd.**, and **Submarine Cables, Ltd.**, was held at the Shakespeare Hotel, Woolwich, on 21st November. Mr. H. May, cable inspector, presided over a gathering of 150. Sir John Dean (chairman of the company) replied to the toast to Telcon.

Mr. Kenn Rogers, the author of "Selling Electrical Appliances" on page 1058 of this issue, was born in 1912 and was educated at Columbia and London Universities. For eight years he was engaged in market research, etc., and after the war opened a self-service "launderette" in Manhattan which became the largest of its kind in New York. Simultaneously he held a washing machine contract with the New York City Housing Authority, an operation which was extended throughout the United States and was eventually introduced by Mr. Rogers into France, Germany, Italy and other European countries. He retired from active business in 1954 and is now preparing a doctoral thesis dealing with some aspects of distribution of domestic electrical appliances.

Mr. K. Rogers

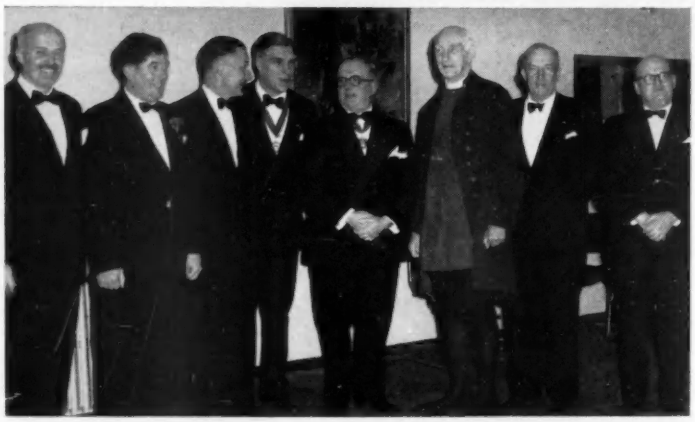
The annual dinner-dance of the North West London Branch of the **Association of Supervising Electrical Engineers** was held on 21st November at the Century Hotel, Wembley. The principal guests were Councillor R. A. Penny (Mayor of Wembley) and Mrs. Penny. In proposing the toast of the Association, the Mayor spoke of the importance of the Electrical Engineers (A.S.E.E.) Exhibition, and the pioneer role played by the Branch in its establishment. Mr. T. G. Murray, Associate I.E.E. (branch chairman), in responding, referred to the important part which the Association played in education and especially of technicians. The toast to the guests was proposed by Mr. J. H. K. Pendry (chairman of the Association) and Mr. H. P. Walker replied.

The Mayor of Wembley (Councillor R. A. Penny), and the Mayoress (left), being received by Mr. T. A. Murray (branch chairman), and Mrs. Murray at the annual dinner-dance of the A.S.E.E. North West London Branch

The Scottish Centre of the **Institution of Electrical Engineers** held its annual dinner-dance on 18th November at the Grosvenor Restaurant, Glasgow. The principal guest was the Rev. Nevile Davidson, D.D., minister of Glasgow Cathedral, who proposed the toast of the Institution coupled with the name of the Scottish Centre. Dr. Davidson spoke of the work of electrical engineers in raising the standard of life but he impressed on them to do all in their power to ensure that the benefits they were able to bestow were used for the advantage of mankind, not for its destruction. The reply to the toast was made by Mr. G. S. C. Lucas, O.B.E., a vice-president of the Institution. The main theme of his speech was the urgent problem of educating engineers and he stressed the great importance of adequate training for technicians as well as chartered engineers. Mr. Lucas also made an appeal on behalf of the Benevolent Fund. The presentation of the Hutcheson-Winning golf trophy was made to Mr. R. J. E. Paterson by Mrs. R. J. Rennie. The toast of the guests was proposed by Mr. W. Adam, chairman of the South-West Scotland Sub-Centre, and this was replied to by Mrs. J. Mendelson, chairman of the Scottish Council of the Electrical Association for Women.

The annual dinner and dance of the Southern Centre of the **Institution of Electrical Engineers** will be held on 18th December (7 for 7.30 p.m.) at the Polygon Hotel, Southampton. Applications for tickets (30s each for members and 15s for graduates and students) should be made by 12th December to Mr. C. G. Brammer, Southern Electricity Board, Magdalen Road, North End, Portsmouth.

At the "coming-of-age" dinner of the Norfolk Electrical Circle recently held in Norwich. Left to right: Mr. H. V. Pugh (chairman, Eastern Electricity Board); Mr. T. A. Wilkes (chairman of the Circle); Mr. S. F. Steward (managing director, Lancashire Dynamo Holdings, Ltd.); Mr. J. A. Sumner (president of the Circle); the Sheriff of Norwich, Mr. C. King; the Bishop of Norwich; Mr. B. A. Robertson (vice-chairman of the Circle) and Mr. E. H. Nichols (vice-president of the Circle)



OBITUARY

Mr. Raymond C. Maher, assistant managing director and export director of Ward & Goldstone, Ltd., Salford, died on 28th November, aged 48 years. Mr. Maher had been with the company for twenty-seven years.

Mr. W. H. Steele.—We are informed by Mrs. Steele that Mr. W. H. Steele, whose death we reported in our issue of 21st November, was educated at Parkstone and Poole Grammar School.

Mr. J. P. Buick.—The death occurred at Bristol on 24th November, at the age of fifty-three, of Mr. James Peter Buick, M.I.Mech.E., Associate I.E.E., who was electrical/mechanical engineer at Berkeley nuclear power station for Balfour, Beatty & Co., Ltd. He had been with the company since 1937.

WILLS

Mr. R. H. Weston, London manager of Jackson Boilers, Ltd., Leeds, who died on 2nd August last, left £11,147 gross (£11,070 net).

Mr. F. L. M. Forsey, sales director of the Engineering and Lighting Equipment Co., Ltd., St. Albans, who died on 26th May last, left £7,865 gross (£7,785 net).

PARLIAMENTARY REPORT

Underground Reactors

In a written reply to Mr. Roy Mason on the construction of underground reactors for atomic power stations, the Prime Minister stated last week that the possibility of underground siting had been considered and if suitable geological conditions could be found at positions fitting into the power network, it would be technically feasible. But the cost would be so much greater than buildings above ground, for power stations of the type and size now being constructed, that it would not be justifiable economically. Suitable power station sites were so scarce that it was probable that they might be used further by building new reactors at the same establishments when those now being constructed became obsolete.

Windscale Pile Dismantling

Mr. Macmillan was also asked if the Windscale piles would be dismantled. He replied that the governing factor was the intense radioactivity in the reactors which precluded the use of normal methods of demolition, such as explosives. Dismantling the sealed concrete vaults and removing their contents could only be started after an interval of, say, ten years, to permit the radioactivity to decay partially, and two or three more years would be required for the actual dismantling. Some hundreds of people and special equipment would be necessary and the cost would be high. Moreover, new provision would be necessary for the safe storage of the radioactive material removed.

The cost of the Windscale accident was difficult to assess. The written-down value of the two reactors, less the value of buildings and equipment which could still be used, was about £3,500,000 at the time of the accident, and they would, in any case, have been written off completely by 1960. The only significant impact had been the loss of milk and dairy products, for which £60,000 had been paid in compensation. The main isotope released was radioactive iodine which lost half its radioactivity every 8 days. Radioactivity from this cause fell rapidly to insignificant levels. An intensified programme of monitoring had confirmed that no harmful amounts of any other elements were released.

Measurement of Radioactivity

Mr. George Ward informed the House that the Royal Observer Corps had more than fifteen hundred posts throughout the United Kingdom for measuring radioactivity.

Consumers' Deposits

Mr. Leslie Hale asked the Paymaster General whether, in view of the recession of trade in the north-western area and elsewhere, he would give a general direction that Electricity Boards should refrain from asking for large deposits as a condition precedent to the installation of electricity in new or re-equipped factories.

Mr. R. Maudling said he understood it was not the normal practice of the Electricity Boards to require deposits before providing supplies of electricity to new consumers.

Electricity for Agriculture

Mr. John Hare, Minister of Agriculture, stated that 2,428 applications for grants under the farm improvements scheme from farmers in Wales had been approved out of a total of 5,639 received. The grants for improvement schemes that had been approved included £1,145,000 for farm buildings and £43,259 for electricity supplies.

Gas-Electricity Co-ordination

Replying to Mr. Braine, Mr. Maudling said that the possibility of greater co-ordination between the activities of these Boards was still under examination by the Committee appointed for this purpose under the chairmanship of Sir Cecil Weir.

Siemens Edison Swan Reorganisation

AS part of the long-term reorganisation of the A.E.I. Group, Siemens Edison Swan, Ltd., is shortly to be divided into three Divisions, Cables, Telecommunications, and Radio and Electronic Components. Controlling these Divisions will be Mr. J. S. A. Bunting, Mr. W. G. Patterson and Mr. J. W. Ridgeway, who will hold appointments on the board of the A.E.I. Divisional Management Co., Ltd.

The Cables Division will commence operation on 1st January next, the divisional general manager being Mr. Bunting. The chief engineer will be Mr. W. G. Hawley, the commercial manager Mr. A. W. Denness, the sales manager Mr. K. S. Estlin and the manufacturing manager Mr. V. L. J. Plascott. The work of this Division will embrace power cables and lines, telephone cable and loading coils, rubber and plastic cables, cable and lighting installation, distribution equipment, and wiring accessories.

The Telecommunications Division will also begin its activities on 1st January next. The divisional general manager will be Mr. Patterson, the chief engineer Mr. F. G. Pheazey, the commercial manager Mr. D. J. Green and the manufacturing manager Mr. J. M. Wilcox. The activities of the Division will cover public telephone apparatus, private telephones, telecommunication transmission, marine, electronic control and indication.

The Radio and Electronics Division will come into operation on 1st January, 1960. The divisional general manager will be Mr. Ridgeway. Details of further appointments, and the range of activities of this Division, will be announced later.

Status of Electrical Technicians

Technical training and the shortage of technicians is a current industrial problem which is not helped by the ambiguity of the term "technician." With this in mind the Association of Supervising Electrical Engineers held a meeting in London this week (1st December) to provide educationalists, industrialists and others with an opportunity to express their views on education, training and the status of electrical technicians. This meeting took place in the lecture theatre of the Institution of Electrical Engineers.

A panel consisting of representatives of the electrical industry and of educationalists led the discussion and answered the many questions which were put from the floor. The panel members were Prof. M. W. Humphrey Davies (Queen Mary College and representing the City and Guilds of London Institute), Mr. J. O. Knowles (chairman, B.E.A.M.A. Council and Education Committee), Mr. B. L. Metcalf (National Coal Board and I.E.E. representative to A.S.E.E. Education and Training Committee), Mr. W. F. Parker (chairman, A.S.E.E. Education and Training Committee) and Dr. J. S. Tait (principal, Northampton College of Advanced Technology and chief examiner, A.S.E.E. Diploma Scheme). The chair was taken by Sir Josiah Eccles (president of the Association) who also acted as "quiz-master" during the question period. In our next issue we hope to publish the main points brought out by the discussion.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £227 5s 0d
Fire Refined 99·70%	ton £226 0s 0d
Fire Refined 99·50%	ton £225 0s 0d
COPPER Tubes ..	lb 2s 2½d
Sheet	ton £258 10s 0d
H.C. wire and strip ..	ton £279 5s 0d
LEAD, English ..	ton £74 0s 0d
Foreign	ton £73 0s 0d
MERCURY	flask £74 0s 0d
TIN, block (English) ..	ton £757 10s 0d
ZINC, G.O.B. Foreign	ton £74 15s 0d
BRASS Tubes (solid drawn)	lb 1s 9½d
Wire	lb 2s 7½d
PHOSPHOR BRONZE Wire	lb 4s 0d
PLATINUM	oz £19 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 24½d—24¾d

INDUSTRIAL NEWS

Vactric Headquarters

New headquarters and showrooms for Vactric, Ltd., were officially opened at 207, Sloane Street, London, S.W.1, last week by Mr. Aubrey Jones, M.P., Ministry of Supply. Apart from being outstanding for its architectural features, Vactric House is also claimed to be the first fully air-conditioned office block to be erected in London. The showrooms and offices alike exemplify a very high standard of indoor decoration and furnishing and the architect, Mr. Ronald Fielding, A.R.I.B.A., who, incidentally, was also responsible for designing the office desks and fittings, including waste paper baskets and letter trays, is to be congratulated.

The main entrance to the showroom on the ground floor is by way of an arcaded approach, off which leads the office entrance hall. Extensive plate glass windows are set back at an angle under an illuminated canopy. Above are four floors of offices, a fifth floor directors' suite, and a roof penthouse containing the air-conditioning plant and lift machinery. Two automatic lifts with stainless steel lined cars

General view of the reception hall of Vactric House

serve all floors, including the basement, which contains a garage for staff cars, and sub-basement.

The building of Vactric House, which is a reinforced concrete framed building, was begun in May, 1957, and was completed in October of this year.

The main contractors were Humphreys, Ltd., and there were more than 40 sub-contractors. All electrical services were carried out by Troughton & Young, Ltd.

Lighting Fittings Exhibition

An exhibition of lighting fittings staged by Harris & Sheldon (Electrical), Ltd., in the Midlands Electricity Board's showrooms at Birmingham last September proved to be so successful that the company put on a similar display, from Monday to Saturday of last week, at the Building Centre, London. During the course of the week many of the company's latest designs of lighting fittings and equipment were inspected by architects, consultants and store managements.

The salient feature of the exhibition was two lines of "Luveline," a twin-lamp fluorescent fitting specially designed to be mounted in continuous rows. Also to be seen were examples of diffusing ceiling panels, and the new "Handslite" range of shallow ceiling mounted and pendant fittings. A display of decorative glass pendant fittings was also shown.

Cows Killed by Shock

On Sunday last nine pedigree Jersey cows at a farm at Tockington, Gloucester, were killed by electric shock while they were being milked. A statement was later made by the South Western Electricity Board that the installation was originally earthed to a water main. Subsequently the water main was relaid, alkathene piping being substituted. This rendered the earthing ineffective when a small fault occurred.

South Wales Board to Pay Damages

Damages totalling £12,127 were awarded to three employees of the South Wales Electricity Board last Monday in respect of personal injuries from burning oil caused by an explosion. While the Board admitted liability for damages it did not admit to any negligence or breach of duty on the part of itself or its officials. The cause of the accident had not been established.

Royal Visit to Siemens Edison Swan

On Tuesday last the Duke of Edinburgh visited the Woolwich Works of Siemens Edison Swan, Ltd. After lunch at the works with Lord Chandos (chairman of Associated Electrical Industries, Ltd., and of Siemens Edison Swan, Ltd.), Dr. J. N. Aldington (director of Associated Electrical Industries and group managing director of Siemens Edison Swan) and the board of directors, the Duke made a tour of the workshops and met managers, engineers and workers. On his way to Woolwich, the Duke visited the Blackheath laboratories.

The Duke of Edinburgh in one of the workshops of Siemens Edison Swan, Ltd., during his visit to the Woolwich Works

New Zealand Trade Agreement

British goods will continue to enter the New Zealand market at preferential tariff rates, but if the New Zealand Government exercises its new freedom to lower substantially the margins of preference, they are likely to encounter increased competition from other countries.

Under the provisions of the outline trade agreement between the United Kingdom and New Zealand signed last week, goods accounting for about 90 per cent of British exports to New Zealand by value are divided into three categories and the New Zealand Government is given the right to reduce the existing margin of preference, guaranteed generally at 20 per cent, to three levels of 5, 7½ and 10 per cent respectively. Electrical equipment and appliances come within the last two categories. Producer goods, such as generators, transmission and distribution equipment, motors, telegraph and telephone apparatus, electric locomotives, factory equipment and most cables and wires are among those on which the margin may be reduced to 7½ per cent; domestic appliances are among those on which the minimum will be 10 per cent. Where the existing margin of preference is already below these levels, and there is an active U.K. trade interest, it will be maintained.

In the past some 30 per cent of U.K. exports have enjoyed margins of preference of above 20 per cent, and it does not follow that New Zealand will proceed forthwith to reduce these margins to the new minimum levels

over the whole field. It is thought likely, however, that in order to bring down the cost of imports she will first cut the margin on capital goods in the first two categories. New Zealand may also be expected to exercise her right to a "limited measure of bilateral trading," which she affirms would not have the object of diverting existing U.K. trade but of "creating new trade by finding outlets for that part of New Zealand's production which cannot be absorbed at remunerative prices in the U.K. market."

The President of the Board of Trade, Sir David Eccles, said last week that the new agreement was similar to that concluded with Australia two years ago, and recognised the substantial changes in the pattern of world trade and in the economic circumstances of both countries.

TV for Italian Nuclear Power Station

A contract to supply television equipment to the first Italian nuclear power station at Latina has been awarded by the Nuclear Power Plant Co. to Pye, Ltd. The equipment will be similar to that being supplied to the A.E.A. establishment at Bradwell which is now under construction.

Suburban Diesel-Electric Locomotives

The first five diesel-electric locomotives out of a total of twenty being built by the Birmingham Railway Carriage & Wagon Co., Ltd., for the Eastern Region of British Railways for use on Great Northern suburban lines are already in service. It is hoped that delivery of the remaining 15 will be completed by the spring of next year. In addition to the new diesel-electric locomotives, 28 two-car multiple unit diesel sets are being put to use to improve services on inner and outer suburban lines. The ultimate plan is for electrification of the Great Northern suburban lines but this will necessarily take some time to complete.

Power is supplied by a six-cylinder Sulzer diesel engine direct coupled to a Crompton Parkinson generator. The pressure charged engine, built at Vickers-Armstrongs, is rated at 1,160 b.h.p. at 750 r.p.m. The ten-pole single bearing main generator is rated at 757 kW, 1,720 A, at 750 r.p.m. Crompton rotating type brushgear, which can be turned to the most convenient servicing position, is incorporated. The traction motors are also provided by Crompton Parkinson. Control gear is by Allen West of Brighton.

Plant for Harwell

The United Kingdom Atomic Energy Authority has placed contracts in connection with the Harwell 7,000 MeV proton-synchrotron. The English Electric Co., Ltd., is to supply rotating machinery to a value of £470,000 and the British Brown-Boveri Co., Ltd., is to build a convertor plant, the value of its contract being £500,000. The plant being built by the English Electric Co. is a 120 MVA machine set weighing 380 tons and comprising two alternators, two flywheels, and two driving motors, all coupled together on the same base. The function of this set is to provide the current pulses for energising the coils of the electro-magnet.

National Poultry Show

At this year's National Poultry Show to be held at Olympia, London, from 10th to 12th December different branches of the industry will demonstrate the application of modern methods. The Egg Marketing Board, for example, will show how eggs are tested for quality, graded by weight, stamped with the "Lion" and packed into the latest types of fibre board containers. The British Broiler Growers' Association will show five stages in broiler production—rearing, breeding, hatching, growing and processing—and automation in the industry will be represented by a complete table poultry processing station.

The Show, organised by *Poultry World* and *Farmer & Stock-Breeder*, will be open from 10 a.m. to 7.30 p.m. on Wednesday and Thursday and from 10 a.m. to 7 p.m. on Friday.

Batti-Wallahs' Society

The phenomenal growth in the demand for petroleum formed the subject of the talk given by Sir Stephen Gibson, former managing director of the Iraq Petroleum Co., Ltd., and associated companies, at last week's luncheon of the Batti-Wallahs' Society. He said that although the discovery of oil went back many centuries, it was not until about the middle of the last century that the industry as such commenced, and he quoted figures showing the rapid rise in demand and the immense amount of capital which was now invested in the industry. Mr. H. H. Spencer (president) was in the chair and he gave the welcome news that Dr. L. G. Brazier (past-president) had now recovered from his illness. Sir Harold Bishop proposed the vote of thanks to Sir Stephen. Mr. T. C. F. Bigland (the "Mate") reminded members that, in accordance with custom, there would be no luncheon in December. The next would be held on Wednesday, 28th January, when the guest speaker would be Mr. Walter Winterbottom, the England soccer team manager.

Domestic Heating Surveyed

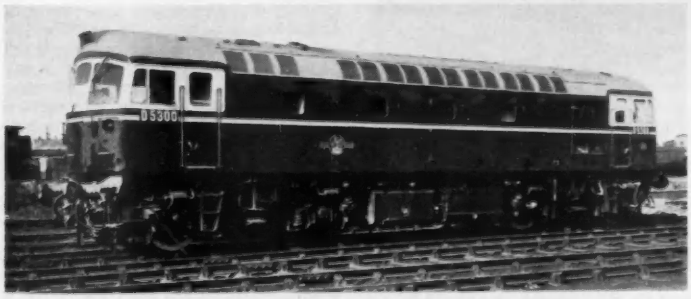
Though the inquiries on which it is based took place in 1955, the recently published report "Domestic Heating," by P. G. Gray (Central Office of Information, price 7s 6d), contains some interesting details of housewives' experiences of different methods of domestic heating and cooking that are worthy of study by the electrical industry.

The information was obtained from a general survey of sample private households in England and Wales and from private households occupying permanent dwellings built since the war by local authorities.

Electric fires were found to be used to some extent for heating in 52 per cent of all houses and 64 per cent of the post-war local authority houses. Electricity was used for cooking by 16 per cent of the general sample compared with gas (62 per cent) and solid fuel (6 per cent)). The percentages in the local authority sample were 20, 61 and 5. Slightly more people were dissatisfied with electric cookers (6 and 9 per cent) than with gas cookers (5 and 7 per cent) but the big difference was for solid fuel cookers where nearly a fifth of both samples were dissatisfied. For electric cookers the main complaints were expense and slowness, and for gas dirtiness and expense. In the local authority sample, only 39 per cent of the tenants said they had been offered any choice of ways of cooking, water heating or room heating, and in each case the choice was between gas and electric cookers.

M.E.M. Anniversary Book

The Midland Electric Manufacturing Co., Ltd., was established by the late Mr. W. L. Barber in 1908 and this year it celebrates its fiftieth anniversary. To mark the occasion it has produced a well-illustrated book entitled "Five Gold Watches." In 1924 the company introduced a scheme whereby employees who completed



1,160 h.p. Type 2 diesel-electric locomotive for British Railways

ten years of continuous service were presented with gold watches. The fifty years of the company's existence is equal to five gold watches—hence the title of the book, which describes the part which the company has played in the development and distribution of electricity over the past half-century. The illustrations (many in colour) show the original premises and workshop and the modern building and workshops of the existing Tyseley factory, together with examples of the company's products.

Ferranti Transformers for Tennessee Valley

Ferranti, Ltd., has secured a repeat order, valued at $420,000, from the Tennessee Valley Authority, U.S.A., for four 50,000 kVA 154/69/13·2 kV single-phase, 60 c/s transformers.

Vacuum Furnaces for Heat Treatment

Special heat treatment processes at the Witton (Birmingham) Rectifier Works of the General Electric Co., Ltd., can now be completed in vacuum, with the recent installation there of two G.E.C. vacuum furnaces. Each furnace has its own control gear and vacuum pumping system.

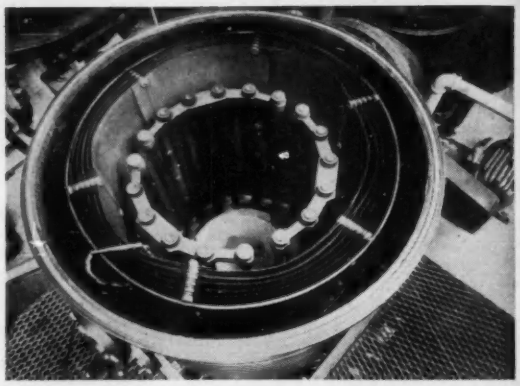
The larger of the furnaces has usable dimensions 24in high and 15in in diameter. The body of the furnace is a water-cooled, vertical, cylindrical, mild steel tank, clad on the inner surface with stainless steel. The tank is covered with a hinged, domed lid which is operated by hydraulics. Faced flanges with rubber seals on the lid and the body of the furnace form a vacuum-tight seal.

The element is an assembly of graphite bars and has a circular section. It surrounds the charge which is heated by radiation. The element operates at a low voltage supplied by a three-phase transformer the output of which is steplessly variable by means of a voltage regulator to give control over the heating rate. The thermal insulation consists of radiation screens of stainless steel and molybdenum sheets arranged to enclose the heating chamber.

The vacuum pumping system consists of a gas ballast pump, a combined booster and oil diffusion pump and a valve block which controls the evacuation of the furnace chamber. An operating vacuum better than 10^{-4} mm Hg can be obtained. The gas ballast pump is interlocked with the power supply so that a failure of the pump automatically causes an interruption in the electricity supply to the element.

The furnace is rated at 120 kVA, which allows for rapid heating, if necessary, to the normal operating temperature of around 1,200 deg C. Provision is made for the forced cooling of the furnace by introducing argon or hydrogen into the chamber.

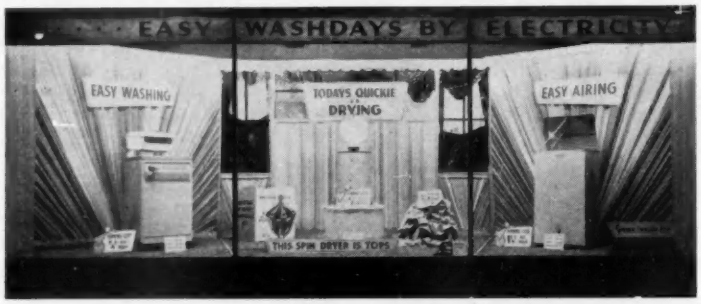
The other furnace is generally similar but has usable dimensions 12in high and 9in in diameter. It will provide temperatures up to 1,800 deg C.



The chamber of the larger vacuum furnace, showing the element assembly and radiation screens

Board's Window Display Competition

Bacup Service Centre, in the No. 5 Sub-Area of the North Western Electricity Board, has been named as winner of the annual window display competition. The winning window was mounted by Mr. J. T. Broadhurst, the service centre supervisor. Over a hundred service centres entered the competition, the theme of which was "Home Laundering by Electricity." The displays had to be produced on a small budget, and were first judged on a Sub-Area basis. The final area judging was conducted by a panel comprising Board members, senior officers and outside display specialists. The winning window made skilful use of animation showing clothes swaying on a line contrasting with up-to-date electric clothes drying appliances. In the foreground a colourful revolving spinning top was used as an "eye-catcher." The second place was awarded to the Kendal (No. 6 Sub-Area). Longsight (No. 1 Sub-Area) and Tyldesley (No. 2 Sub-Area) tied for third place. Other Sub-Area winners were Poynton (No. 3 Sub-Area) and Chorley (No. 4 Sub-Area).



The winning display by the Bacup Service Centre in the North Western Board's window display competition

New Conway Bridge

The Conway suspension bridge is being replaced by a steel spandrel braced arched structure, supported by four steel arched ribs, which is to be opened on 13th December by Mr. H. Brooke, Minister of Housing and Local Government and Minister for Welsh Affairs. Power and telephone links will be carried across the river by the new bridge. The 350-yard lengths of air-spaced, dry-core, paper insulated quad local telephone cable manufactured by British Insulated Callender's Cables, Ltd., will be slung across the bridge on cleats. Furthermore 33 kV paper insulated power cables of three and four cores, also made by B.I.C.C., are installed in the stonework of the bridge.

Mine Winder Orders

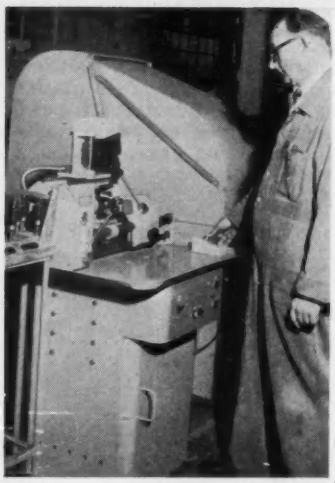
Further contracts have been placed by the National Coal Board, West Midlands Division, No. 1 (North Staffordshire) Area, with the A.E.I. heavy plant division, Rugby, for four winder equipments very similar to those already on order for Wolstanton Colliery. The new orders are valued at nearly £700,000. Each winder consists basically of a 3,300 h.p., 20-pole d.c. motor which is overhung from the winder pulley shaft. The associated motor-generator set consists of a 2,400 kW generator driven at 500 r.p.m. by a 3,000 h.p. slipring induction motor. Closed-loop control and winder protective equipment are also included. All the winders are designed for operation on the cage-and-counterweight principle to a maximum depth of 3,900ft, although individual duties differ slightly. The original order covered two mineral winders for Wolstanton No. 3; the new order is for service shaft winders, to wind men and materials in addition to coal. One winder will be installed

at Wolstanton No. 2, one at Hem Heath No. 1 and two at Florence. The mechanical equipment is to be made by Vickers-Armstrongs (Engineers), Ltd., as sub-contractors to the A.E.I. heavy plant division.

Exhibition of Electronic Products

A permanent exhibition of the products of E.M.I. Electronics, Ltd., was opened last week at their factory at Hayes, Middlesex. At the opening, Lord Brabazon of Tara surveyed recent trends in electronics and discussed the main items of equipment being exhibited. He emphasised the fact that the application of electronics was long overdue in many fields.

A number of new items of equipment were on show and included the figure reading device (FRED). This apparatus can read either optically or magnetically with the aid of specially prepared inks, at speeds of many thousand characters per second. A special typeface that varies little in appearance from standard numerals has been designed to allow maximum tolerance. The accuracy of the size



Electronically controlled armature undercutting machine

and shape of the numerals is well within the capabilities of all normal printing processes. In its magnetic form, the applications of FRED include the reading of cheques and invoices for sorting or feeding information into accounting machines. The apparatus can also be used for reading route information or serial numbers on conveyors or railway trucks. This application was demonstrated at the exhibition by the use of a model railway.

A new electronically controlled machine which automatically undercuts a wide range of fractional horsepower motor armatures was also demonstrated. The armature is held in a quick release collet and a photoelectric servo system controls the selection and cutting of each slot in turn at a rate of up to one slot per second.

Other new items of equipment shown included a machine tool control system which employs the basic principles of other "Emicon" electronic positioning control systems but is designed to meet the needs of the small batch producer. Some new electronic components and data processing equipment for computers were also shown and a colour television system was demonstrated.

Educational

Courses arranged at the Manchester College of Science and Technology include a course of six lectures, commencing on 14th January, on "Circuit Elements and their Use in Electrical Measurements," and a course of eight lectures, commencing on 17th February, on "Presentation of Technical Information."

Scottish Domestic Science Conference

The Edinburgh and Borders Area of the South of Scotland Electricity Board recently acted as hosts at a week-end conference in Peebles Hydro Hotel to 115 domestic science teachers from schools throughout the area covered by seven different education authorities. Mr. C. H. A. Collyns, manager of the Edinburgh and Borders Area, welcomed the delegates and Mr. James D. Dundas, convener of Peebles County Council, officially opened the conference. The object of the conference was to afford opportunity to the domestic science teachers to discuss the use of domestic electrical equipment, to present to the delegates information on the latest developments, to enable them to examine modern equipment at first hand and to provide a platform where they could raise any problems relating to electricity and the teaching of domestic science. Papers on the electric cooker, refrigerator and home laundry were presented and discussed.

British National Electrics, Ltd.

British National Electrics, Ltd., announces that it has ceased manufacturing domestic electrical appliances. The supply of spare parts and components and the overhaul of existing appliances will continue to be handled through the branches of the parent company, Johnson & Phillips, Ltd.

Price Reductions

Atlas Lighting, Ltd., has reduced the price of the 5ft 80 W "Popular Pack" fluorescent fitting to £4 19s 8d complete (including tax) with G.P. quick-start white tube.

The price of the "Ekco" single tube 5ft 80 W fluorescent batten fitting, F51035 (Ekco-Ensign Electric, Ltd.), has been reduced to £4 19s 8d. This price includes a white or warm-white bi-pin fluorescent tube, which is packed with every batten. An 8ft 125 W size has been introduced to this range of "035" battens. The price of £8 10s includes a white or warm-white bi-pin fluorescent tube.

Julius Sax & Co., Ltd., have reduced the prices of their gongs, fire alarm systems and trickle chargers.

Calendar

"All Aglow" is the title of the picture which adorns the calendar received from Courtney, Pope (Electrical), Ltd., showing a charming lady skier.

Change of Address

The Society of Engineers is moving on 15th December to Abbey House, Victoria Street, Westminster, London, S.W.1. The telephone number will remain unchanged.

Engineering Centre

Because of the implication that its permanent exhibition is confined to Birmingham firms the Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham, 2, has changed its name to "The Engineering Centre." This in no way affects the structure or operation of the organisation.

Trade Announcements

Birlec, Ltd., announces that the division handling absorption plant and gas generators, formerly known as the Dryer Division, has been renamed Dryer and Gas Plant Division.

Evershed & Vignoles, Ltd., have opened a district office at 14, Yarm Lane, Stockton-on-Tees (telephone: Stockton 64288), in the charge of Mr. W. H. M. Hoyle. The northern area office at 116, Manningham Lane, Bradford, 8 (telephone: 28083), will continue to hold an overall responsibility for the Northern Counties.

The Carlisle branch office of **British Insulated Callender's Cables, Ltd.**, is now at Durranhill Industrial Estate, Harraby, Carlisle (telephone: Carlisle 22221).

F. Hull & Sons, Ltd., have acquired the sole production and selling rights of the "Denny" scintillator, together with the right to the use of the name "Denny," and in future this magnetic scintillating light device will be produced solely at its works at 174, London Road, Mitcham, Surrey.

The **Sturtevant Engineering Co., Ltd.**, has formed within its central organisation a Cathodic Protection Department headed by Mr. J. H. Morgan, who has recently joined the company. Inquiries regarding cathodic protection should be addressed to the head office, Southern House, Cannon Street, London, E.C.4.

Portaway Earthing Equipment, Ltd., has been formed to market the apparatus implied by the title. Porter Electrical Products, Ltd., which hitherto has handled this business, will continue to exist to deal with the manufacturing and other lines or services.

Applications of Artificial Dielectrics

Summary of three papers, "The Use of Dispersive Dielectrics in a Beam Scanning Prism" by J. S. Seeley, B.Sc.(Eng.), Ph.D., and J. Brown, M.A., Ph.D.; "The Quarter-Wave Matching of Dispersive Materials" by Dr. J. S. Seeley; and "Theory of Reflections from the Rodded-Type Artificial Dielectric" by A. Carne and J. Brown, which were presented to the Radio and Telecommunications Section of the Institution of Electrical Engineers on 24th November

By J. S. SEELEY, B.Sc.(Eng.), Ph.D.

SEVERAL applications of radar would be more readily facilitated if materials were available which had properties not usually associated with conventional dielectric materials. Examples of these properties are a refractive index which can be varied to any value required or which exhibits a high degree of dispersion (i.e. changes rapidly with frequency). A material which exhibits very small surface reflections would also be extremely useful. It is possible to produce variations in the refractive index of conventional dielectrics, as in the case of loading synthetic resins with various powders to produce highly refracting materials, and in the expansion of polystyrene to form dielectrics with a refractive index near unity, while maintaining a certain amount of mechanical strength.

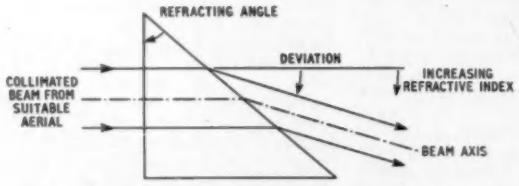


Fig. 1.—Beam scanning prism

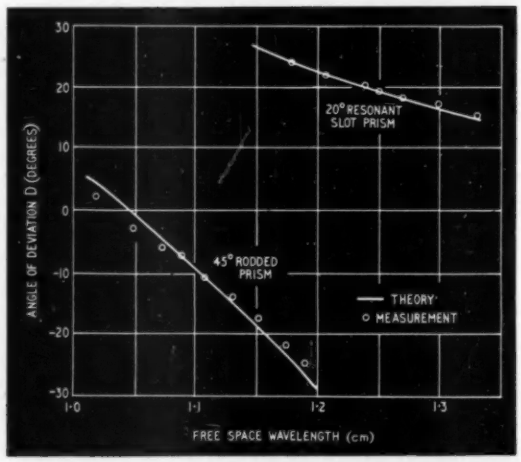


Fig. 2.—Measured performance of experimental prisms. Beam swing is increased as prism angle is increased. Shortage of material limited resonant prism to 20 deg

However, the range of these techniques is limited and there are several disadvantages in the finished products. No conventional dielectric has the necessary natural dispersion to be of use where a highly dispersive material is required, and the other useful property, that of eliminating surface reflections, is accomplished only with matching arrangements which involve intricate machining processes.

The requirements under discussion can be fully met only by using one or other of the so-called "artificial" dielectrics. These are fabricated materials in which the molecular dipoles, by which a solid dielectric material refracts an electromagnetic wave, are synthesised by regular arrays of such conducting elements as curtains

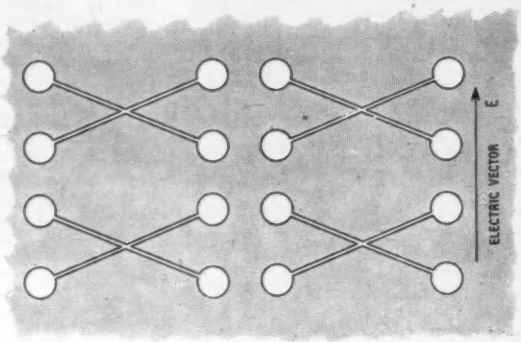


Fig. 3.—Pattern of resonant slots

of wires, spheres, discs, sheets, etc. Theory and experiment have shown that these arrays exhibit the refracting properties of conventional dielectrics when the spacing of the array is less than half the operating wavelength and is desirably less than one-tenth of it. The microwave region of the electromagnetic spectrum (frequency range 3-100 Gc/s) is obviously the only practicable one where applications of the artificial dielectrics can be made. Laboratory tests on large samples are most easily carried out at the upper frequency end where the array spacings are of the order of 0·3-4 cm.

One type of artificial dielectric, that in which the refractive index is always greater than unity, has already achieved considerable application in microwave aerials. These arrays, of which the stepped metal-plate lens is a typical example, usually have refractive index values near 2 and are substantially non-dispersive. The recent

investigations have been concentrated on two other types of artificial array, the "rodded" dielectric and the "resonant slot" dielectric. The rodded artificial dielectric consists of an array of rods with their axes parallel to the direction of the electric vector of the incident wave. When a solid dielectric is loaded with this array, the wave impedance of the combination can be made equal to the free space impedance at two frequencies so that surface reflections are eliminated.

A radome can be designed on this basis to be almost "invisible" over wide ranges of frequency and angle of incidence. The same array can also be made highly dispersive by spacing the rods apart in the direction of propagation nearly to the permitted maximum, i.e. of the order of a half-wavelength. In effect, the artificial dielectric is then a series of directly-coupled half-wave resonators and so is highly frequency sensitive.

The other type of dispersive array which has been investigated in detail is one in which the dispersive mechanism is due to a resonance in the reflecting properties of the elements themselves. This is directly analogous to the various resonant dispersions in conventional dielectrics. For laboratory experiments the elements used were sheets containing patterns of resonant slots, and in accordance with reasoning based on the physical mechanism, the dispersion is increased by making the spacings between the sheets as small as possible.

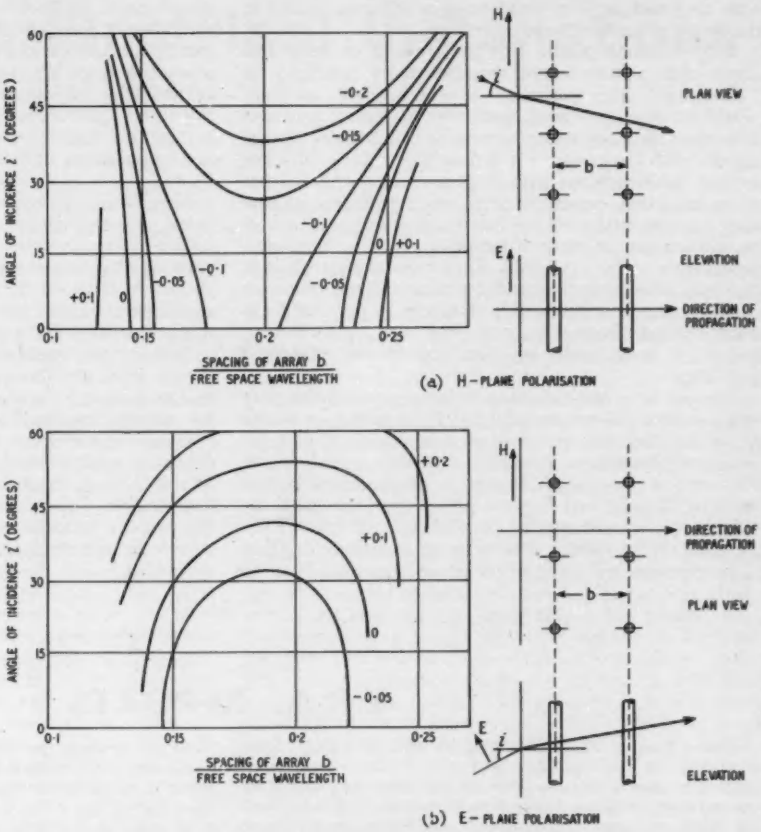


Fig. 4.—Computed intensity reflection coefficient contours. (a) H-plane polarisation. (b) E-plane polarisation

The arrangement suggested for the use of a highly dispersive material in a beam-scanning prism is shown in Fig. 1. Small changes in frequency will alter the refractive index and hence the angle of emergence from the prism, so that with frequency modulation the system produces beam scanning without moving parts. The advent of broad-band oscillators with electrically-controlled tuning, such as the travelling wave tube, has made this proposal feasible.

The measured performances of two experimental prisms are shown in Fig. 2. In the case of the rodded dielectric the measured beam swing is in good agreement with the predicted values, but there is a restriction on the theory for the resonant array in that the Q-factor and resonant frequency of the closely-spaced arrangements of slots have to be determined experimentally before any computations can be made.

A typical pattern of slots is shown in Fig. 3 and it can be seen that the spacing of the pattern is less than the length of the individual slot. It has been found that coupling between these slots is responsible for increasing the resonant frequency by as much as 20 per cent and decreasing the Q by a factor of three as compared with the isolated resonant element. It is not possible at present to calculate this reduction in the effectiveness of the resonant elements or the shift in resonant frequency. The overall performances of the two dispersive arrays for beam scanning are shown in the accompanying table. It is suggested that 20 deg would be the largest practicable

PROPERTIES OF DISPERSIVE PRISMS FOR BEAM SCANNING

Rodded Dielectric	Resonant Slot Dielectric
(a) 20 deg Beam Scan	
Frequency swing required < 9 per cent. The spacing of the array has to be increased to the maximum that can be tolerated.	Frequency swing < 13 per cent. The spacing must be reduced to the minimum.
(b) Reflection Losses	
Reflections at the surfaces are liable to be considerable for the highly dispersive array.	The reflection characteristic passes through zero in the middle of the swing and is increased at the edges by increasing the dispersion.
(c) Attenuation Losses (45 deg prism, aperture 20 wavelengths)	
Maximum attenuation should not exceed 2·8 dB along the axis. For the major part of the swing the attenuation will be considerably reduced.	Attenuation at the resonant point should not exceed 1·5 dB. This will be the smallest value; there is no information about the general level.
(d) Other Features	
(i) The mean refractive index of the array is less than unity so that larger prism angles are required.	The mean refractive index (at resonance) is equal to unity.
(ii) The larger spacings involved might result in small amounts of power being scattered at the refracting surface for large prism angles.	With small prism angles there will be no scattering loss at the refracting surface.
(iii) Dispersive theory is reasonably exact.	Q and resonant frequency (and hence the dispersion) have to be determined empirically.

scan to avoid various disadvantages inherent either in the arrays or in their use in prism form.

The reflection losses can be reduced to very low levels over a considerable bandwidth by matching or "blooming" the surfaces. Straightforward methods would not produce a good result with dispersive materials since the reflections which have to be matched out change rapidly with frequency. If a matching grating of wires is used the behaviour with respect to frequency is that of an inductive, capacitive or resonant reactance so that with an appropriate choice the frequency-dependence of the grating can be partly balanced against the frequency-dependence of the material. Such a matching technique has been used with the rodded prism, and the reflection coefficients over a bandwidth of nearly 20 per cent have been reduced from 0·39, 0·41 and 0·50 to 0·16, 0·03 and 0·26 respectively by matching at the mid-band frequency.

For use as a low-reflection radome material the very small surface reflections exhibited by a particular design of rodded dielectric are illustrated in Fig. 4 (a) and (b). Contours of constant reflection coefficient are shown as functions of wavelength and angle of incidence for the cases of H-plane and E-plane polarisation (i.e. with the electric vector respectively parallel and not parallel to the axes of the rods). The extreme variations in plane of polarisation and angle of incidence represented by the figures cover all likely conditions at the inner surface of a radome. The reflections at large angles of incidence can be further reduced by selecting the wall thickness to provide a large amount of cancellation by interference between the reflections from the inner and outer faces. For three layers of rods the power reflected by the radome will be less than 7 per cent at the design wavelength for any polarisation and for all angles of incidence up to 80 deg.

Experiments with a section of the rodded dielectric in a 10 cm waveguide (necessarily limited to H-plane polarisation only) have verified the behaviour in giving very small reflections at varying wavelengths. Because the array is two-dimensional, the treatment for normal incidence at varying wavelengths can be easily generalised to give results at any angle of incidence.

Both of the applications under discussion have been shown to be feasible and could be readily developed if the need arose. Some care in production methods would be required to reduce attenuation losses. The precautions suggested are that all conducting contacts must be firmly soldered and that the r.f. surface conductivity of the elements must be as high as possible. A 10 per cent tolerance in positioning is allowed for the rods in the radome material and this is sufficiently generous to permit its manufacture by weaving conducting wires into glass cloth.

E.R.A. REPORTS

Power System Problems.—Report Ref. V/T132 "Data Required for the Solution of Power System Problems" (price 6s) gives in tabular form all the items on which data are required before a power system analysis begins, including those relating to synchronous machines, transformers, cables, overhead lines, system operation and other studies. The items are classified for routine or special studies, and they are also sub-divided into those on which information is essential to the study, and those on which some knowledge is desirable if the study is to be most thorough or if the importance of secondary effects is to be assessed.

Magnetic Domains.—An electrical analogue for elucidating the domain structure in a picture frame specimen of a single crystal of iron is described in report Ref. N/T78 "An Electrical Analogue of Magnetic Domains" by P. F. Davis (price 4s 6d). Two forms of the analogue, which may be used for finding either the magnetic energy or the field associated with a domain structure, are described in this report. One consists of a square mesh network of different gauge resistance wires, those having the highest resistance per unit length being run in the direction analogous to the direction of magnetisation of the domain. The other form consists of parallel plates of resistive material immersed in an electrolytic tank.

Iron Losses.—The work described in report Ref. N/T77 "An Investigation into the Causes of Excessive Iron Losses in Electrical Machines" by D. A. Jones (price 10s 6d) was carried out when steel manufacturers were changing from hot rolling to cold rolling, and illustrates some of the problems encountered. The investigation was undertaken to develop a method of measuring the iron loss of stator cores before they are wound and discover the cause of the variation in iron loss which occurs between apparently similar machines. Most of the investigations were carried out on the stator cores of a water cooled induction motor, referred to as a T Q W machine.

Some type of toroidal winding is necessary if the cores are to be tested before they are wound. The time taken to introduce a winding suitable for working off the available supplies is the main difficulty of the test. Each core of the T Q W machine would have required 50 turns of 15 A cable and a secondary winding of 50 turns to supply the voltmeter and wattmeter, and this is a serious objection to this type of test if the cores are to be checked in a production line. A solution was found by constructing a step-down transformer and energising the stator core by a single turn.

Discharge on Insulants.—In report Ref. L/T364 "The Effects of Small Discharges on some Insulating Materials—II. At Atmospheric and Reduced Pressures" by N. Parkman (price 18s) the behaviour of alkyd and phenolic thermo-setting mouldings when discharges impinge upon them has been investigated and the significance of the results is discussed. Apparatus has been developed to prevent discharges extinguishing with time and to permit tests under various ambient conditions. The effects of surface area and conductivity on discharge magnitude and life have been examined, and results of measuring the frequency spectrum of discharges have been used to predict the area discharged instantaneously as a function of surface conductivity. It was found that reducing ambient pressure from 76 to 25 cm Hg causes a marked lowering in the level for thermal instability, and that alkyd material has greater resistance to discharges than phenolic over this pressure range.

Organic Compound Polymerisation.—An investigation into the possibility of polymerising organic materials by the action of high energy radiation is described in report Ref. L/T360 "The Polymerisation of Organic Compounds by Ionising Radiation" by C. E. King (price 7s 6d). The investigation is largely confined to the examination of aromatic hydrocarbons and an account is given of the types of materials obtained. An electrical discharge provided the main source of energy, but use was also made of the linear accelerator at St. Bartholomew's Hospital.

Copies of these reports are available, at the prices indicated, from the Publication Sales Department of the Electrical Research Association at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

Adequate Electrical Installations

PROCEEDINGS OF I.E.E. SYMPOSIUM

LAST week a symposium on the provision of adequate electrical installations in buildings was held at the Institution of Electrical Engineers in London. The symposium had been arranged by the Utilisation Section of the Institution and took place under the chairmanship of Mr. R. A. Marryat, the Section chairman.

In his introductory remarks, Mr. Marryat said that although 14 years had passed since the "Post-War Building Studies" were issued the many excellent recommendations contained in "Electrical Installations" (Post-War Building Studies No. 11) with regard to the provision of adequate electrical installations in buildings had not yet been fully implemented. Although there had been marked improvement in the provisions for distributing electricity in buildings since the pre-war era, it was probable that the overall position had deteriorated during this period. Bearing in mind the continued and rapid development of new electrical applications it was apparent that any installation which was only just adequate for present-day needs might well be found totally inadequate during the useful life of the building that it was intended to serve.

A well-planned and adequate electrical installation was an investment that would undoubtedly pay valuable dividends. The utility of any building largely depended upon the adequacy of its internal wiring and nothing hastened obsolescence more than lack of provision for additional current, when and where needed. It had never been possible to lay down, in the Institution's Wiring Regulations, what should be regarded as an adequate installation for any particular building. Although the Regulations were not intended to take the place of a detailed specification it would appear that mere insistence upon compliance with these Regulations had sometimes been thought to excuse the complete omission of such a specification. It was also used as an excuse for inadequate and indefinite particulars in contracts issued for competitive tendering; drawings showing the position of outlets immediately required afforded little indication of the provision for future development. In such circumstances any immediate saving achieved by competitive tendering must be found illusory.

Specification Preparation

The preparation of such a specification was often difficult even for those fully conversant with the industry, for many factors had to be taken into account, such as the immediate and anticipated use of all the space provided, the impact of future developments, the economics of capital expenditure in relation to the expected life of the building, and the general æsthetic effects it might be desired to achieve. The design would be controlled, to some extent, by the type of building construction concerned and the symposium had been prepared with a view to promoting discussion of the subject within the wide circle of industry concerned with the building industry generally.

After Mr. Marryat had spoken, four papers were presented each of which dealt with one general type of building. In attempting to deal with such a broad subject the authors were naturally unable to treat exhaustively all the detailed variations that must occur in practice, but they presented a general outline of the essential provisions that should be made for adequate wiring of each type of building.

The first paper was presented by Mr. C. A. Belcher (London County Council) who dealt with multi-storey flats and maisonnettes. He said that the criterion for an adequate electrical installation in a dwelling was its ability to cope with the day to day demands made by the householder's family when supply was required for lighting, cooking, heating and motive power. The steadily increasing use of domestic electrical aids now available demanded a liberal conception of adequate socket-outlet facilities if we were to avoid the crude and even dangerous improvisations that some householders were driven to adopt in their endeavours to make all their electrical ends meet. The number of points to be provided was inevitably governed by cost, and this was particularly so in subsidised buildings, with which the paper was mainly concerned.

Sociological Aspects

The sociological aspects of the problem were made the subject of a special study in London. The results showed that an allocation of three socket-outlets in the living-room, one in the kitchen (apart from the cooker control unit), two in each of the larger bedrooms and one in the small bedroom was a reasonably adequate basic allowance for flats and maisonnettes built for letting by municipal authorities. The cost of such an installation was about 2 per cent of the total cost of the dwelling. Looking ahead one might reasonably expect to find greater use of electrical appliances in the kitchen and also localised lighting from standard and table lamps in the living-rooms and bedrooms. The substitution of a double socket-outlet for one of the single points in each room would meet these requirements and this would only increase the total cost of the installation by 0·1 per cent of the cost of the premises.

In his paper on installations in houses Mr. Colin C. Hyams (president, Electrical Contractors' Association) reiterated Mr. Belcher's criterion. He said that the number of appliances which were considered essential in a house in the medium price range continued to increase, and the installation must be planned, in the first instance, to provide the facilities which it was known would be required. Equally important, however, was the anticipation of extensions which might be needed in the future and the inclusion in the basic design of facilities which would permit these extensions to be carried out without undue cost or inconvenience to the householder.

Labour was no longer freely available for domestic employment, and its place was being increasingly taken by electrically driven machines. These machines and appliances could only be effective if the means of operating them was readily to hand, and since the electrical installation accounted for only some 2½ per cent of the total building cost, it might be considered unwise to practise too rigid an economy in this section of the building specification. Surprisingly, whenever it was found that the total estimated cost of a dwelling was too high, cuts were almost invariably first made in the electrical installation.

This approach could only be ascribed to misunderstanding, since, quite apart from the small percentage of capital expenditure which the electrical installation represented, the cost of extension at a later date was quite out of proportion to the figure which should have been included originally. In addition, the avoidance of the

irritation which an inadequate installation introduced from the very moment of occupation was surely worth the small cost involved.

In dealing with commercial buildings Mr. E. E. Jacobi (Troughton & Young, Ltd.) said that the problem of providing adequate wiring installations in office buildings was not only technical but economic, as the property owner had to reduce his capital expenditure to the minimum to receive an adequate return for his outlay. It was, however, true that he could not provide a building of this nature without services, nor could he expect the tenant to provide them at his own expense. A building erected today without services could not easily be let, and, if let at all, only at a low rent.

To some extent the two problems of minimum cost and of adequate services might seem incompatible, but the balance between the limitation of expenditure on the one hand and the provision of adequate services on the other could be achieved by good design. It was therefore necessary—paradoxically enough—to lay emphasis on design economy, rather than increased wiring, to achieve the adequacy of service that was required.

When he presented his paper on small industrial premises, Mr. J. A. Sharpe (Midlands Electricity Board) said that the choice of a suitable wiring system was becoming increasingly difficult, since there was such a varied selection of systems available. Many small industrial premises were completely planned by architects with occasional assistance from specialists. Some of the results were very far from being sound engineering jobs and usually involved the occupier in additional expenditure within a very short time of taking over the premises. It must be appreciated very early in the planning stage that factories, however small they might be initially, would expand, and provision must be made to cope with this expansion.

To substantiate this point: practically every installation one examined would be found to cater only for the installed load of the premises with very little tolerance on switch and distribution gear, sub-mains, etc., to accommodate further expansion. Fairly tidy and neat layouts of switchboards were added to, with odd switches here and there, until the installation became untidy, unsafe and altogether an unsightly affair. To cater for future development, at least 25 per cent spare capacity should be allowed on main control gear, distribution boards and sub-mains.

A further hazard which continually faced the electrical contractor was the lack of accommodation for electrical equipment. Some schools of thought still dwelt on the odd corner for the electricity and gas services, and however much one contrived to segregate these services, it was a practical impossibility to do so. This clearly indicated the necessity for better liaison between architect, consultant and contractor before the final planning of the project had been reached.

Although many contractors had the facility for planning such jobs, it was primarily a task for consulting engineers. Tendering alone was a very costly item in a contracting organisation, and to be asked to extend this to the preparation of specifications and drawings might result in the client receiving proposals which were below standard. A consulting engineer, who made full use of the numerous wiring systems at his disposal, could make a substantial saving in the cost of the installation.

Owing to lack of space the report on the discussion is held over until next week.

A TRANSISTOR COMPUTER

THE first transistor electronic digital computer designed to provide fully automatic control of many industrial processes is being developed by Ferranti, Ltd. It is about the size of two small office filing cabinets and the first production models are expected to be available in 1960. This will be the first time that a computer of this type, designed for process control, will use transistors instead of the conventional thermionic valves and, as a result, it will measure only approximately 4ft by 4ft by 2ft.

At present, in the prototype stage it is technically known as the PCTC (process control transistor computer). The transistor logical circuits in the computer have been thoroughly tested and an experimental model has controlled a machine which simulates a plant process for more than 2,000 hours' operation without component failure. Additional vibration and temperature tests have also been carried out to simulate the most rigorous conditions the computer is likely to meet in industrial use.

The computer is being specifically developed as the centre unit in control systems for a variety of industrial processes, such as may be found in the power, chemical, oil, gas and steel industries. Babcock & Wilcox, Ltd., and their associated company Bailey Meters & Controls, Ltd., are currently investigating with Ferranti, Ltd., the feasibility of using this new computer for the control of boilers during start-up and shut-down.

Probably the most important factor is that this computer opens the way for fully automatic control of many industrial processes because it can operate continuously for long periods under arduous industrial conditions without the necessity to regularly shut down for preventative maintenance. Not only will this type of computer calculate alterations that have to be made in any process, but also provide the control signals to automatically carry out these alterations.

The price of the new computer will probably be between £20,000 and £50,000, depending on the size of the installation.

First transistor computer (PCTC)

NEW BOOKS

Logical Design of Digital Computers. By Montgomery Phister, Jr. Pp. 408; figs. J. Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 84s.

The approach adopted by Dr. Phister in this book is somewhat controversial since he tends to treat the logical designer as a special person, skilled in the mathematical manipulation of logical equations, and not necessarily having any sound engineering background. This is unfortunate since considerable value can be derived from this book by everyone concerned with the design of computers, provided this hurdle can be overcome.

There is, unfortunately, a tendency in some branches of computer activity to assume that the only engineer needed is a circuit designer who produces relatively simple circuits and who is therefore a junior member of the organisation. The logical designer, on the other hand, should have widespread knowledge of the complete equipment and its applications, and be a man skilled in the manipulation of symbols as well as an engineer. At first sight Dr. Phister's book encourages this belief. However, on reading it closely, he does emphasise the essentially practical nature of logical design and also notes that, no matter how much elegance can be attributed to the development of the logical equations, the very best computers will always show signs of inventive genius and flashes of inspiration. In other words, the book would have been even more valuable had it been more obviously intended for the computer engineer.

Like most American books, its size should not be taken as being indicative of a massive treatment of all aspects of logical design of all types of computers; in fact, only a small aspect is considered, namely, the design of serial synchronous computers with simple arithmetic facilities—consideration is not given to division or floating point arithmetic. In the analysis of this restricted aspect, Dr. Phister does go into very considerable detail and leads the reader through the various stages of design slowly and carefully, and in a very readable way.

Indicative of the American approach is the use of phrases such as the "Huffman Moore model of the digital system." Also, as is usual in books of this type, the index is there in name alone and is by no means as extensive as it should be in a book which, if it is to be used, should be used constantly. The author, as he says in his introduction, does provide a very large number of exercises at the end of each chapter. However, he does not include even summary answers, and thereby makes the job of a student trying to work through the book even more difficult than it would otherwise be.—B.W.P.

Electrical Engineering Practice. Vol. I, 6th Edition. By J. W. Meares and R. E. Neale. Pp. 716; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 60s.

When a book reaches its sixth edition, it must possess considerable merit, and that is the case with the volume under review. The general plan of the book remains unaltered: Part I covers definitions, materials and measurements; Part II deals with the generation and cost of electrical energy; and Part III with the transmission and distribution of electrical energy.

One of the main virtues of the book is that it contains a considerable amount of data relating to equipment and materials used in the generation and distribution of electrical energy, and much of this has been brought up-to-date by several well-known contributors. All the same, one wishes that the blue pencil had been used more ruthlessly to delete matter that is now only of historic interest. There are too many descriptions finishing with "This is now obsolete" or words to that effect. Also, greater attention should have been given to the replacement of obsolete terms by their modern equivalents, and it comes as a shock to find a hysteresis loop with its horizontal axis labelled "Magnetising field H in lines/sq cm."

The c.g.s. units are used throughout, apart from a brief reference to M.K.S. units near the beginning of Chapter I. Students requiring explanations of the action of instruments and machines will find this volume of little assistance; but to those who are concerned with the supply industry the book should prove most useful, especially as the bibliography at the end of each chapter gives valuable information concerning the relevant British Standard Specifications, textbooks and I.E.E. papers.

The size and price of this volume would have been appreciably reduced and its usefulness enhanced if all obsolete matter had been deleted.—E.H.

Magnetic Recording Handbook. By R. E. B. Hickman. Pp. 176; figs. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 21s.

The author has assembled in one volume a comprehensive selection of interesting and useful information on all aspects of his subject. Despite any claim to the contary, the book is more suitable for the general reader than the professional, but service engineers wishing to widen their knowledge of this rapidly extending technique may find the general treatment helpful.

The book opens by tracing the development of magnetic recording from its beginnings in the latter part of last century up to the present time and continues by explaining in some detail the theory of the basic processes now used. A chapter follows in which the various parts of a typical recording system from the tape or wire recording medium to the microphone are discussed in turn, and a selection of commercial equipments is then surveyed at some length to illustrate modern techniques, fully illustrated with photographs, diagrams and circuits. Such a chapter cannot be exhaustive but, nevertheless, some readers may wonder at the omission of one of the most widely used tape decks. Further chapters follow on practical recording, maintenance and servicing and on special uses such as TV and machine tool control. Finally there are a bibliography and appendices on legal aspects and standards.

It will be seen that a great deal of ground is covered and it would be unreasonable to expect a highly technical treatment throughout; there are, however, a number of loose or incorrect statements which irritate. The author refers for instance to a T.R.F. using a crystal diode as an infinite impedance detector, and the higher frequencies being lost when a crystal microphone is presented to too low a load.—B.R.B.

BOOKS RECEIVED

Classified Examples of Electrical Engineering. By S. Gordon Mark. Pp. 147; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Kingsway, London, W.C.2. Price 15s.

Fourth National Symposium on Vacuum Technology Transactions. Edited by Wilfred G. Matheson. Pp. 176; figs. Pergamon Press, Ltd., 4 and 5, Fitzroy Square, London, W.1. Price 90s.

Selling Domestic Appliances

AN AMERICAN LOOKS AT BRITISH OPPORTUNITIES AND METHODS*

After showing how far the British domestic appliance market is from "saturation," the author suggests the ways in which manufacturers and distributors must think and act to secure public interest in their products

By
KENN ROGERS

AFTER extensive experience in the United States and in a number of Continental countries I am glad to have had the opportunity of making a study of British practice in the selling of domestic electrical appliances. This article is a brief account of what I have found and in it I venture to make a few comments and suggestions which, coming from an independent source, may be of some assistance to British manufacturers.

In a recent *Financial Times* article Dr. Mark Abrams expressed the view that there has never been any prospect that the average British household would be so well equipped with durable consumer goods as its counterparts in the rest of the English-speaking world. Hopes that Great Britain might catch up with some of her Continental neighbours had been dashed by the restrictions imposed on the sale of appliances in this country. It could be argued that for roughly 85 per cent of the population such appliances (he was not referring specifically to electrical equipment) would remain "unwanted luxuries."

I cannot believe that Dr. Abrams' conclusions can be wholly correct. Otherwise why should British manufacturers engage in such extensive advertising and sales promotion? And a visit to any store will reveal a public gazing longingly at the magnificently gleaming refrigerators, washing machines and a host of other appliances.

But though I question Dr. Abrams' conclusions I am inclined to accept his figures as probably reasonably accurate. According to him, only the top 4 per cent of the population, by income, has anything like a reasonable saturation of household appliances. In the lower middle class there are only two items—lawnmowers and TV sets—which have so far reached half the available homes. But the real shock of the figures comes when we look at the so-called prosperous working class where the head of the household earns at least £11 per week. No less than a third of the population falls into this category. Here 93 per cent are without refrigerators and 78 per cent without washing machines. Only the classless TV set has achieved a saturation of over 50 per cent. When we come to the other half of the working class, which represents another third of the population, over half the families are even without a TV set, not to speak of other domestic appliances.

Dr. Abrams' data are of necessity incomplete. We should ask ourselves—How is it that 85 per cent of the households are still without the benefits of electrical equipment? Dr. Abrams' study is in terms of income of the head of each household. However, many working-class families have two, three and even four wage earners and therefore a total income of £15, £20, £25 or even more per week. Hence, the total net income (after tax) of a working-class household may equal or exceed the net income of the professional classes and senior industrial managers.

The pattern of spending differs greatly between the middle- and working-class families. A working-class family may well have more "spending" money than a middle-class family receiving the same gross pay, as I have just emphasised. The middle-class family has many calls on its purse. Mortgage payments, a car, a holiday, entertainment at home, clothes and children's education are all things which bite into the family's budget.

Sub-standard Homes

The working-class family is much more likely to be living in a council flat with a controlled rental or in a dwelling rented from a private landlord. It does not spend money on education or on improving property.

Another factor is the housing problem. Anything from one to five million of the nation's homes are considered to be sub-standard. At the present rate of residential construction and allowing for the normal population increase, a considerable proportion will have to go on living in unsatisfactory homes for many years to come, irrespective of their income which may be comparatively high.

Consequently, about the only way in which these tenants can brighten up their homes, is by putting a TV set into their dimmed sitting rooms. Then some appliances in the kitchen should represent the logical next step. Although this seems to be a logical step, it has, nevertheless, not yet been accomplished. Is this, as Dr. Abrams implies, because the manufacturer has reconciled himself to the idea that in Britain durable consumer goods have only a limited market of potentially 15 per cent of the population? I do not think so.

In the past 15 months I have had opportunities to study several companies of various sizes in this industry. My observations have extended from the board room to designing, production, advertising, marketing, and to the sales floor at both the wholesale and retail levels. As a result, I have come to the conclusion that contrary to Dr. Abrams' views, factors of a different nature may well account for the situation in which appliance ownership is spread so thinly.

Until very recently the industry has been beset by Government restrictions, of which my readers will know far more than I do. Now these barriers are beginning to be removed. This year there was a welcome reduction in purchase tax on a number of items, among them refrigerators and washing machines. The result as far as we can tell at this date, has been a reasonable impetus to sales without, however, causing a runaway boom.

For nearly 20 years, during the war and during the

* This article is based upon a talk recently given to the Standing Committee of the B.E.A.M.A. Domestic Electrical Appliances Section.

period of post-war restrictions, production was one of industry's most important problems. The effort to maintain production in the face of shortages, labour difficulties, and Government restrictions, was accompanied by problems of finance such as the credit squeeze, and this in a time of constantly rising costs. To overcome it the industry developed first-class production techniques and astute financial management. I think, in respect of the latter, we Americans can learn a trick or two. But, to go on, the sales force too often had to take second place in the scheme of things. I would suggest that as a result there are at present not enough first quality, experienced salesmen in the ranks of top-level management. However, if we are to move out of our current economic slow-down, 1959 will have to be a sales year; the influence of sales managers on the decisions of management will have to become far more direct than it has been.

Another thing is that there seems to be something of an aversion to salesmanship in Great Britain which has to be overcome.

Market Research

It is my impression, and this has been corroborated by a considerable number of people in the industry to whom I have spoken, that with many companies there is often an inadequate knowledge of the market and in particular of the consumer. Many companies do not go beyond the processing of internal production, sales and stock statistics if they go that far. I know that some executives pay ardent lip service to market research, but how many make full use of the information available, even within their own organisation, not to speak of going out into the field to find out what the consumer is really like and really wants ?

With a great many companies I have visited I could not help but notice a tendency to assume that what the designer's or manager's wife likes the public also desires. Sometimes, no doubt, the best decisions are made by a committee of one. However, a sample of one in market research is always grossly misleading. Another impression I have gained is that too many executives are too busy with too many things. They never or very rarely have a chance to sit back undisturbedly and think out long-term problems that face their industry, as opposed to the day-to-day routine.

Taking all these factors together, the result has tended to nurture a situation where products are bought by the consumer rather than sold to him. The family longs for a TV set; industry makes one available. Social compulsion gets to work, more families want TV sets, so industry makes more of them. However, a marketing effort to make the same families want a refrigerator or a washing machine seems to be missing.

In time, obviously, the industry would successfully readjust itself to changed conditions. In the process some companies may take an even more advanced lead over others, irrespective of their size. There are, however, at least three important factors which make it imperative to act promptly and decisively. They are:—

(*a*) European economic integration is on the way. So is German competition. The Common Market starts on 1st January, 1959. A Free Trade Area will probably follow. This will bring German and other Continental manufacturers into the United Kingdom market. A leading German firm have already made a complete and detailed survey of the British market. A few weeks ago their research team went back to Germany with a market survey prepared for them here. With typical German thoroughness they came over here to spot-check the findings and take them back as a basis for decisions by their board. Their plan is to graft Italian design on to German technical expertise. In 1957 the imports of German electrical household appliances into this country were double those in 1956. This year further increases are reported. And this before any of the proposed schemes come into effect.

(*b*) American companies declare they will enter the area of the proposed European economic integration with first-class up-to-date production facilities operating in the area. In a recent issue *Time* reported:—

> "The Common Market represents the first time that American industry can compete on an American basis in Europe. . . . Many U.S. firms are holding back to see if the proposed European Free Trade Area . . . a community of 240 million potential customers will happen; they would prefer to get into England under lower tariffs, thus gain access to the Commonwealth trading area as well as the Common Market. . . ."

(*c*) Dollar import restrictions on consumer goods are to be relaxed. This will, to my knowledge, bring at least three major American companies into the British scene within the next 12-18 months. Each of them intends to present a complete line of electrical household appliances.

Predicting the shape of things to come is a rather hazardous undertaking and so I hesitate to express an opinion on the number of units such increased foreign competition may be able to place on the British market. However, the real impact will be out of all proportion to these numbers. This is simply because of their generally far advanced marketing ideas.

Such a development could be viewed with apprehension. Actually it offers a major and most welcome opportunity for the industry and the market it serves. Some British companies, by the practical application of the modern marketing concept with a view to satisfying the needs of their market, have met with a rewarding measure of success.

Definition of Marketing Concept

At this juncture it will be asked: What is this new marketing concept and how does it differ from the old selling concept ? There are several definitions in answer to the first question. Professor Drury of the N.Y.U. Department of Marketing has suggested that it is "the production of markets." Peter Drucker terms it "the entire business seen from the point of view of the consumer." James Jewell, vice-president in charge of Westinghouse marketing, relating his company's transition from one concept to the other, stated earlier this year:—

> "For too long have we regarded the customer primarily in terms of our needs to influence him favourably toward our products. Our (new) marketing concept requires that we recognise him as an important source of information on needs and desires—with this information serving as a basis of planning and controlling our entire operation."

We would agree here to-day that the problem of analysing the British market according to modern marketing concepts is urgent. There is insufficient information available about the impact of "electric living" on the British household in spite of the fact that the means to obtain such information are available.

As a start here are some of the questions that could profitably be asked:—What effect has appliance ownership on social standing ? What effects have labour-saving appliances on the behaviour of members of a family ? What are consumer attitudes in regard to appearance and styling of appliances ? What is the consumer image of the various appliances ? How do families make their buying decisions about appliances ? How do attitudes to these problems change according to socio-economic groups ?

It will be noticed that these questions are far more concerned with consumer attitudes than with marketing as a traditional concept. The time for nose-counting alone has passed. To make marketing effective, it is essential to combine modern techniques of social and psychological research with the use of traditional market research.

It should, however, be borne in mind that research in itself is not and never has been a substitute for decision-making on the part of management. The genuine function of research is to provide management with a new, more accurate and more dynamic role. Research cannot take the place of management but it can give management an opportunity to take decisions far in advance of changing market conditions, whether of an economic, competitive, technological, social or political nature.

There are pitfalls, however. They appear in the form of over-eager university researchers or sometimes inadequately informed "admen" who may cause dislocation and delay. Too often they bring forth emotion-drenched, would-be motives for the consumer, put into pseudo-technical psycho-analytical language. While this may be misleading, messy or just amusing, it is rarely relevant to the manufacturer's problem. All the manufacturer wants is to improve his trading position, i.e. for consumers to buy and re-buy his products.

The researcher should have a thorough knowledge of social and psychological factors, such as the six mentioned before, and how they work. Equally, he should have sufficient business experience to know what points are practical and useful and what is merely interesting but useless information. The answer may well lie in work by a research team which includes marketing men, social psychologists and a go-ahead business executive.

This, of course, is an answer in which I have a vested interest as a researcher. I do not happen to be the sort of academic who believes knowledge of itself to be a sufficient reward. It must be sought for some useful purpose. And this kind of research is useless unless it can be associated with a forward-looking industry in which there are enough leaders with courage to take calculated risks, who have imagination for development, and realistic responsibility for making profits.

I have learned that this is needed because there are so many other manufacturers outside this country who are willing and ready to take up opportunities offered here. But I feel sure that this can be done better in this country because of the experience available—if the industry is prepared to make a joint effort.

International Convention on Transistors

AN event which should have an important bearing on the future of world electronics will take place in London next year when the Radio and Telecommunication Section of the Institution of Electrical Engineers holds an international convention on transistors and associated semi-conductor devices. This will take place at Earls Court from 21st to 27th May. Under the same roof the I.E.E. is taking the initiative in promoting the first international scientific exhibition devoted entirely to these devices. The combined event will represent the most comprehensive meeting in the world yet to be held on transistors and allied developments. All the major industrial countries will be represented, including the United States and the Soviet Union, and it is expected that at least 2,000 delegates will take part.

Acceptances to invitations to deliver the opening lectures at the convention have already been received from the American inventors of the transistor, Dr. W. B. Shockley, Dr. W. H. Brattain and Prof. J. Bardeene. For their work on the transistor these three physicists received the 1956 Nobel Prize for physics.

The convention will be divided into twenty-three sessions, twelve of them general and eleven specialist. Apart from the opening session, which will be concerned with world trends in transistors and associated semi-conductor devices, the sessions will cover: materials; basic theory; characteristics and their measurements, and transistors as circuit elements; technology and design and manufacture; and applications of transistors. Including over thirty lectures from invited speakers of international repute, the total number of papers to be submitted at the convention is expected to exceed 200.

BRITISH STANDARDS

A NEW British Standard dealing with sulphuric acid for lead-acid batteries (B.S. 3031 : 1958) has just been issued by the British Standards Institution. It specifies limits for the presence of: residue on ignition, chloride, sulphur dioxide, combined ammonia, nitrogen (other than combined ammonia), iron, copper, manganese and arsenic. This is followed by nine appendices, each containing a detailed method for determination of these constituents. A final appendix provides a formula for calculating the volume of sulphuric acid to be taken for test.

There are no requirements for the strength of the acid, since it is normal trading practice for the purchaser to specify this when ordering. It should also be noted that amendments to B.S. 454 (train lighting accumulators) and B.S. 2550 (traction batteries for electric road vehicles) will take account of the requirements of this publication.

Copies of B.S. 3031 : 1958 may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 4s 6d.

A Standard test finger is used to determine whether metal parts which might become electrically "live" are adequately protected from human contact. The test is specified in a number of British Standards for electrical equipment and is routine procedure in the publications of the C.E.E. (International Commission on Rules for the Approval of Electrical Equipment).

Experience has shown that a new British Standard, devoted exclusively to the test finger, is desirable to obviate repetition of detailed requirements for the device in the many British Standards where the test is needed, and to prevent undesirable variations in the detailed design and dimensions of the test fingers used.

This Standard has now been published as B.S. 3042 : 1958 and it gives the form and method of use of a test finger as required by the relevant British Standards and publications of the C.E.E. Copies may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 3s.

NUCLEAR SCIENCE LABORATORY

THE 1956-57 annual report of the Royal Military College of Science, Shrivenham, mentions that the Rutherford nuclear laboratory, which is divided into the two sections of chemistry and physics, is now in full operation. New experiments and demonstrations are being developed continuously by the staff of the physics branch of the College. In particular a scintillation gamma-ray spectrometer has been set up and put into operation. In addition to the instruction given in this subject to the technical staff, the first advanced course in nuclear science and technology was held during the year. A programme of improvements of instructional and living accommodation, estimated to cost £10,000, was launched during the period covered by the report and is proceeding according to plan.

Investigation of Power-Follow

I.E.E. SUPPLY SECTION DISCUSSION

IN our last issue we published authors' summaries of papers entitled "Investigation of Power-Follow Current Phenomena Using a Synthetic Power Source" and "The Impulse Initiation of Arc Discharges," which were presented at a meeting of the Supply Section of the Institution of Electrical Engineers on Wednesday, 26th November.

The discussion on these two papers was opened by Dr. C. E. R. Bruce (Electrical Research Association), who said he had a special interest in the papers because he had made the suggestion in 1941 that spark breakdown depended on the arc in the leader stroke of the long spark and lightning discharges. Spark breakdown was one of the most important problems in the whole field of discharges in gas. He felt sure the papers would long provide a happy hunting ground for workers in the still little-worked field of the transitions between the glow and arc discharges. He suggested that it was not surprising that the critical current required for the initiation of arc conditions in a leader stroke (about 0·5 A) was the same as the critical current required by the authors to initiate arc follow currents. Even more interesting than power-follow current was the initiation of spark discharge, and along this line the investigations made by the authors would be extremely interesting to physicists.

Arc Initiation

Mr. H. Edels (Liverpool University) referred to work he had done on arc initiation some years previously and expressed pleasure that the authors' experiments agreed fairly closely with the predictions he himself had made. The object of his own work, however, was not to discuss follow-through current but to devise a circuit which for the experiments he was conducting on arc discharges would produce an arc without the necessity for bringing the contacts together or even for fuse wire.

Describing the problem as he saw it at the moment, he said that the power input suddenly decreased enormously; therefore losses increased tremendously. The power source tried to force through current and one curve went down suddenly while the other would try to get up, and the voltage must try to fall. This in no way differed from the problem of the circuit-breaker. If the voltage was high enough it would produce sufficient energy to decrease the current and give ignition. The solution depended upon a knowledge of the losses of the gap which under transient conditions were extremely difficult, even under steady-state conditions.

Mr. E. T. Norris (Ferranti, Ltd.) said that he supposed a completely synthetic circuit had some academic interest, but one wondered if the authors need have deprived themselves of both 50 c/s power and transmission lines, seeing that neither was very hard to come by, except perhaps in a university. However, they had provided forcible arguments for claiming that their circuit imitated the real thing. The authors had given useful information, particularly at a time when theories on lightning surges on transmission lines were in the melting pot and the experts were busy thinking up new ones. Perhaps something might emerge shortly that would give fuller information.

Mr. J. S. T. Looms (Central Electricity Research Laboratory) said that one of the many worries at present was attempting to design breaker switches for heavy current generators. He had found the authors' feast of information a little indigestible and would have been glad of a few generalisations. One more phenomenon to add to an already considerable list was that time-lag characteristics and impulse response might be affected by the presence of oxide dust on the cathode. The authors' experiments led to the conclusion that the establishment of heavy current follow-current was substantially independent of the impulse provided it did initiate the arc. Impulse current from lightning strokes might well exceed the current by order of magnitude, in which case the impulse did not merely clamp or hold the gap in a conducting state but stored energy firmly. One wondered whether there might be an energy criterion analogous to the case of gas mixture initiation where a discharge of energy might be sufficient in a given gap with low-voltage current.

Mr. A. M. Cassie (Electrical Research Association) dealt with aspects of the authors' theoretical treatment of their problem. He expressed the view that they had tended to treat discharges too much from a static point of view. Both the impulse discharge regime and the period of power circuit instability which followed it were essentially transient and hence called for dynamic treatment. To make clear his own point of view, he recalled the principal features of the dynamics of arc discharges. He suggested that throughout the two papers the importance of the spark seemed to be minimised.

Mr. M. Ouyang remarked that the synthetic circuit was not very realistic because of the current flowing through the transmission line. He thought the authors might have got on better if they had shown across the gap a certain parameter prior to firing the impulse generator.

The authors briefly replied.

Convention on Thermonuclear Processes

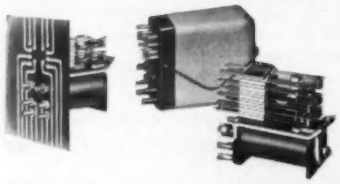
ONE of the most significant of recent developments has been the prospect of harnessing thermonuclear power for peaceful purposes. In recognition of the important part which Britain has played in this field the Institution of Electrical Engineers has arranged a convention on thermonuclear processes which is to be held in London on 29th and 30th April, 1959.

In view of the rapidity with which the subject is developing details of the programme have not yet been completed, but the probable range of topics to be covered will be basic physics of thermonuclear processes, prototype British thermonuclear experiments, constructional features of ZETA I, design problems in future ZETA type systems, and possibilities of direct conversion from nuclear to electrical energy. Reviews of related work in the United States and the Soviet Union will also be included in the programme. Further particulars and registration forms are available from the Secretary of the Institution at Savoy Place, Victoria Embankment, London, W.C.2.

NEW ELECTRICAL EQUIPMENT

Sub-Miniature Relay

Up to six sets of contacts can be fitted to the Mark III version of the PAR type P.3 relay announced by D. ROBINSON & CO., 717, London Road, Hounslow, Middlesex. The heavy duty contacts are rated at 5 A, 240 V a.c. or 24 V d.c., and the contact material permits moderately inductive loads to be switched. The relay, which is suitable for operation in an ambient temperature of 100 deg C, if specified, has maximum dimensions of



Sub-miniature relay (D. Robinson & Co.)

1·7in by 1·5in by 0·765in. Slugged, single or double wound coils are available, with resistances up to 9,000 ohms, having a consumption ranging from $\frac{1}{10}$ to $1\frac{1}{2}$ W, depending on the contact arrangement.

Cable Clips

Plastic clips in moulded polystyrene, with pre-fixed hardened steel nails, for fixing coaxial, telephone and other small round cables to walls and supports are announced by PERIHEL, LTD., 146, New Cavendish Street, London, W.1. A range of clips in brown, ivory or grey is available for cables from $\frac{1}{4}$in to $\frac{3}{4}$in diameter, priced from 2s 5d to 4s 3d per hundred.

Multiple Circuit Timer

The Type AMS miniature synchronous timer introduced by the ELECTRICAL REMOTE CONTROL CO., LTD., The Fairway, Bush Fair, Harlow, Essex, comprises an electromagnetically operated clutch, continuously and independently adjustable calibrated time setting dials each associated with a snap action change-over switch, an adjustable mechanism to reset the timer within a half-second, and a miniature synchronous motor.

Standard timers can be supplied with one, two or three change-over switches and corresponding time setting dials rated for a switching capacity of 10 A, 250 V a.c. with a non-inductive load, or 6 A, 250 V a.c. with an inductive load.

Suitable for operating from a 230 V or 110 V, 50 or 60 c/s single-phase a.c. supply, the timers have a power consumption of 10 VA. Transformers and d.c./a.c. conversion units can be provided to give operation from alternative supplies. Ten standard timing ranges are available, from 0-30 seconds to 0-48 hours.

Fibre Skirting Ducts

A new skirting duct wiring system, made of fibre, has been introduced by the KEY ENGINEERING CO., LTD., Larkfield, Kent. It provides a neat and practical method of power and telephone distribution, and has the appearance of conventional skirting, although containing within its construction a number of wiring compartments. Apart from simplicity of installation it allows for subsequent changes in outlet position to be rapidly and inexpensively carried out without disfigurement of wall surfaces.

Power or telephone points can be readily installed by cutting through the face of the duct and mounting a suitable fitting on its surface. The re-positioning of an outlet point merely involves repetition of this procedure, a blanking plate being supplied to cover the abandoned point. Removable corner panels allow easy access, and permit new cables to be drawn in. Where a duct run above desk height is more convenient for portable electrical equipment or telephones, a variation of the skirting model is available. This has its lower and upper edges contoured so that it may be installed as a decorative dado. Both types are produced in 8ft lengths and in two thicknesses (1in and $1\frac{3}{8}$in). They can be cut to special lengths on site as required, with conventional woodworking tools. Any number of wiring compartments can be incorporated and a wide variety of moulded edges is available.

Infra-Red Heaters

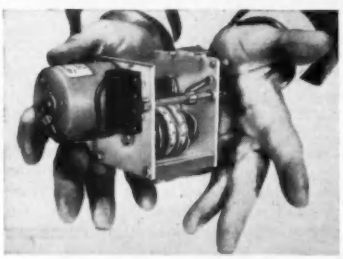
The new "Sunglow" range of infra-red heaters, obtainable from G.B.M. (ELECTRICAL) BIRMINGHAM, 439-443, Moseley Road, Birmingham, 12, is suitable for either wall or ceiling mounting and models in $\frac{3}{4}$, 1 and $1\frac{1}{2}$ kW sizes are available. The heaters measure 27, 39 and 51in in length and are finished in a range of stove enamelled colours, with hammered gold safety guards. The prices, including purchase tax, are £4 5s 5d (750 W), £5 16s (1 kW) and £7 18s 6d ($1\frac{1}{2}$ kW). Industrial models, in a similar range of loadings and sizes, with silver grey finish, are available priced at £3 12s 6d, £4 18s 6d and £6 15s respectively, tax free.

Rotary Switches

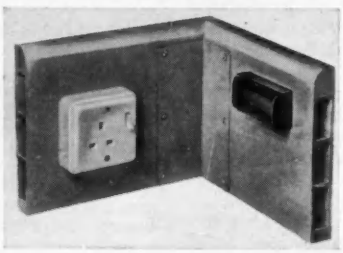
The maximum use of non-metallic material, including melamine and nylon, has been made in the range of Type C cam-operated low voltage switches introduced by CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks. The switches comprise a number of stages each carrying two double-break silver alloy contacts, up to 12 stages being accommodated on a single column. For a larger number of stages two or more columns may be operated in tandem by a single handle.

The range of attachments available includes auxiliary contacts operated by pulling or pushing the switch handle, facilities for locking the switch in any position and interlocking with adjacent switches, and a unidirectional device to ensure that a prearranged switching sequence is followed.

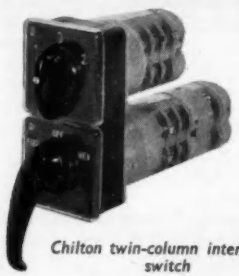
The switches, primarily designed for use on a.c. circuits, are available in six ratings, ranging from 16 to 200 A, but normal rated current can be made,



ElRemCo synchronous timer



Key Engineering ducted skirting



Chilton twin-column interlocked switch

carried or interrupted in d.c. circuits up to 32 V, above this value an additional pair of contacts must be connected in series for each 32 V increase.

Bottle Cooler

The "Prestcold" model BC.86 bottled beverage cooler has been developed for use in licensed premises, hotels, etc., by the PRESSED STEEL CO., LTD., Cowley, Oxford. It has a gross capacity of 4·3 cu ft and provides facilities for cooling and storing 86 half-pint bottles, plus several smaller bottles in an upper door shelf. Two 30-cube ice trays and a large chill tray for short period storage of ice cubes are also provided.

A "Presmetic" power unit incorporating a compressor and motor, hermetically sealed in a steel case, is

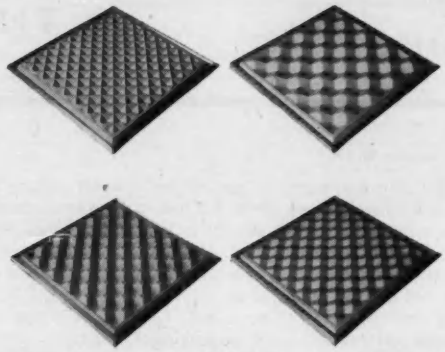
"Prestcold" model BC.86 bottled beverage cooler

fitted and the refrigeration system, also sealed, is charged with "Arcton 6" refrigerant. The cabinet measures 36in high by 24in wide by 25in deep and is finished in white or cream stoved enamel. The acid resisting, vitreous enamel table top can be obtained, in addition to white or cream, in green, blue or red. Models can be supplied with the door hinged on the left-hand side at no extra cost.

Lumenated Pyramid Ceiling

The latest design in lighting to be introduced by LUMENATED CEILINGS, LTD., Alliance House, Caxton Street, London, S.W.1, utilises the basic components of the company's module ceiling but offers four new designs of translucent modules, each of which provides a separate optical effect. The three-dimensional designs are based on a repeating pyramidic pattern and can be used either separately or in combination with each other, or with the standard plain or patterned lumenated module panels, to give a wide variety of attractive layouts. Each module is vacuum-formed from 0·015in thick vinyl plastic sheet, the pattern itself providing the necessary rigidity. To retard dust, the panels are subjected to an anti-static process and they can be lifted out by hand when necessary for cleaning.

The cost for a large installation is



Four of the pyramid ceiling designs introduced by Lumenated Ceilings, Ltd.

approximately 10s per sq ft. A country-wide service for the marketing and application of the new ceiling already exists as the manufacturers recently announced that they were to work closely with the General Electric Co., Ltd., in combining design, development and marketing resources for all their architectural lighting systems.

Wall Brackets

The latest additions to the range of wiring accessories manufactured by NETTLE ACCESSORIES, LTD., Warren Street, Stockport, Cheshire, are wall brackets, available in switched or unswitched form. They are designed to fit all wall boxes having 2¾in fixing centres or alternatively can be mounted directly on to a flat surface. In the case of the switched wall bracket a contemporary type lampholder is supplied and both the lampholder and the switch are wired. No lampholder is supplied with the unswitched wall bracket. The wall brackets and lampholders are available in a range of colours including black, white, red and dove grey. The prices per dozen of the unswitched brackets without lampholders are £3 12s (black) and £4 8s (coloured). The switched models with lampholders are priced at £7 2s 6d (black) and £8 17s 3d (coloured) per dozen. The wall brackets are subject to purchase tax but where the lampholder is supplied separately, only the wall bracket is taxed.

Thermostats

The production of thermostats formerly manufactured by Cyril Kieft & Co., Ltd., has now been started by R. B. PULLIN & CO., LTD., Phoenix Works, Great West Road, Brentford, Middlesex. Several models are available with temperature ranges from 30 to 90 deg F, including wall or conduit box mounting types and a plug-in model for 13 or 15 A sockets designed to replace the ordinary three-pin plug and give thermostatic control of any electrical space heating appliance; a neon light is fitted to indicate when the heater is connected.

Pullin thermostat

These thermostats are enclosed in cream coloured phenolic resin covers measuring 4¾in by 2in by 2in. Production of a new 20 A room thermostat on a plastic base with metal cover will be starting shortly.

The overall size will be 4¾in by 2in by 2in and the temperature range 35 to 75 deg F. The thermostats, which carry a one-year guarantee, incorporate a double action micro-switch with silver contacts, and are controlled by a non-current-carrying bimetal strip with a temperature differential of 2 deg F.

Laundry Irons

With the introduction of two new laundry irons the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, now provides a choice of three sizes of industrial irons with two weights in each size, ranging from 6 lb to 15 lb. The latest two models are a 6 lb iron (type HO5756) and an 8 lb iron (type HO5758). The sole dimensions of both are 7½in by 4¾in and the loading is 750 W. They have polished steel chamfered soleplates, shaped bodies of polished aluminium, and cork handles with wooden end pieces.

All the irons in the G.E.C. laundry range are fitted with three yards of 3-core flexible, and single-heat elements. A separate wall-mounted "Simmerstat" control is suitable for all models and other accessories include a substantial iron stand and alternative types of flex support.

One of the new G.E.C. laundry irons

DOMESTIC ELECTRICAL EQUIPMENT

THERMAL STORAGE WATER HEATERS

AN adequate supply of really hot water is one of the essential needs for quick and efficient work in the kitchen. A popular method of providing a constant supply is by means of a self-contained, or thermal storage, electric water heater. Heaters in this form can be readily adapted to any existing pipework and can be obtained in various sizes ranging from small sink models (1½ to 3 gal) to larger types (20, 30 or 40 gal) suitable for supplying most of the taps in a house, including the bathroom. These larger capacity water heaters are particularly useful in flats and converted houses for, being floor mounting types, they will fit unobtrusively under the draining board or in a corner.

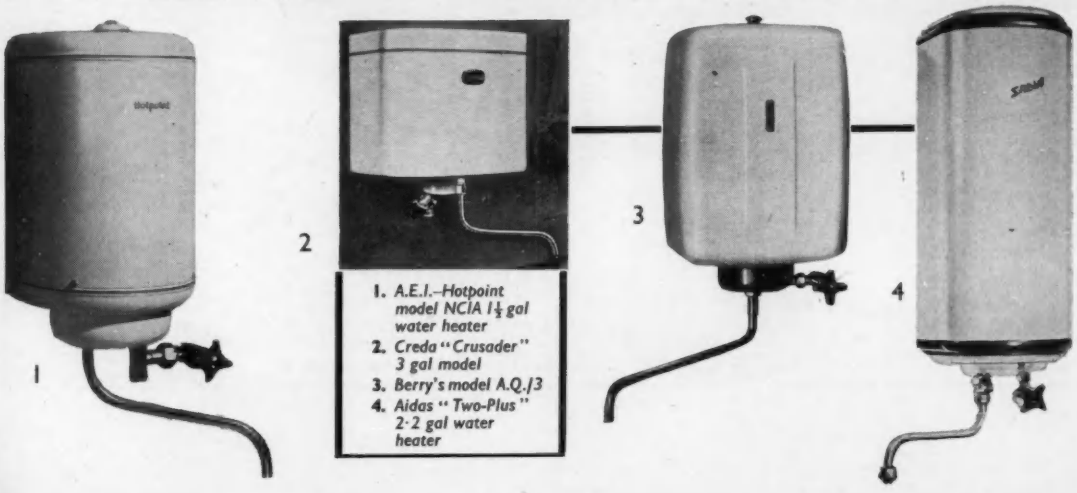
The running costs of electric water heaters bear favourable comparison with other forms of water heating. Hot water can be stored ready for immediate use and when a supply is drawn off it is replaced at the rate of approximately half-a-gallon every ten minutes.

Basically, thermal storage water heaters consist of a copper water container within a sheet steel outer casing, with either fibreglass or granulated cork insulation. This efficient lagging, plus the fact that all models are thermostatically controlled, prevents any undue waste of electricity.

The pressure types receive their cold water supply from the storage tank and are not designed for connection direct to the water mains. They can, however, work in conjunction with a fuel-fired domestic boiler as additional hot water storage tanks during winter or as all-electric water heaters during the warmer months.

Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
A.E.I.—HOTPOINT, LTD., 33, Grosvenor Place, London, S.W.1.	NC1A (a) NC2A (b) NC3A (c)	Non-pressure, wall mounting, flat back	1½ gal (a) 2·2 gal (b) 3 gal (c)	1 kW (a) 1·5 kW (b) 2 kW (c)	White or cream, red trim, chromium outlet	£10 12 6 (a) £11 0 0 (b) £12 9 0 (c)	£2 9 9 (a) £2 11 6 (b) £2 18 4 (c)
	NC 5A (a) NC12A (b) NC15A (c)	Non-pressure, wall mounting, cylindrical	5 gal (a) 12 gal (b) 15 gal (c)	1 kW (a) 1·5 kW (b) 1·5 kW (c)	White stoved enamel	£20 17 6 (a) £28 13 0 (b) £32 3 6 (c)	£4 17 9 (a) £6 14 1 (b) £7 10 7 (c)
	PC 5A (a) PC12A (b) PC15A (c) PC20A (d)	Pressure, wall mounting, cylindrical	5 gal (a) 12 gal (b) 15 gal (c) 20 gal (d)	1 kW (a) 1·5 kW (b) 1·5 kW (c) 2 kW (d)	White stoved enamel	£19 3 0 (a) £26 18 0 (b) £30 8 0 (c) £40 9 0 (d)	£4 9 8 (a) £6 5 11 (b) £7 2 4 (c) £9 9 4 (d)
	PB30A	Pressure, floor mounting, cylindrical	30 gal	4·5 kW	White stoved enamel	£61 11 6	£14 8 3
	SA 5A (a) SA12A (b) SA15A (c) SA20A (d) SA30A (e)	Cistern, wall mounting, rectangular	5 gal (a) 12 gal (b) 15 gal (c) 20 gal (d) 30 gal (e)	1 kW (a) 1·5 kW (b) 1·5 kW (c) 2 kW (d) 3 kW (e)	White stoved enamel	£31 15 0 (a) £42 5 0 (b) £47 13 0 (c) £58 4 6 (d) £68 12 6 (e)	£7 8 8 (a) £9 17 9 (b) £11 3 0 (c) £13 12 6 (d) £15 17 2 (e)
	ND2A	Non-pressure, under-sink, rectangular	2 gal	2 kW	White stoved enamel	£18 18 6	£4 8 7
AIDAS ELECTRIC, LTD., Sadia Works, Rowdell Road, Northolt, Greenford, Middlesex.	G	Wall mounting, free outlet	1½ gal	750 W	White or cream with coloured bands	£10 10 0	£2 9 2
	"Two-Plus"	Wall mounting, free outlet	2·2 gal	1 kW	White or cream with chromium mouldings	£10 10 0	£2 9 2
	H	Wall mounting, free outlet	3 gal	1 kW	White or cream with coloured bands	£12 0 0	£2 16 2
	"Select"	Rectangular wall mounting, free outlet	3 gal	1 kW	Various colours with chromium mouldings	£13 10 0	£3 3 3
	U.T.C.	Wall mounting, pressure	3 gal	1½ kW	White or cream with coloured bands	£12 12 0	£2 19 0
	U.T.C.	Floor mounting, pressure	3 gal	1½ kW	White or cream with coloured bands	£13 2 0	£3 1 4
	B	Wall mounting, free outlet (A) or pressure (B)	5 gal	1 kW	White or cream with coloured bands	£17 0 0 (A) £16 0 0 (B)	£3 19 7 (A) £3 14 11 (B)
	L	Wall mounting, free outlet (A) or pressure (B)	7½ gal	1 kW	White or cream with coloured bands	£19 0 0 (A) £18 0 0 (B)	£4 9 0 (A) £4 4 3 (B)

Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
AIDAS ELECTRIC, LTD., Sadia Works, Rowdell Road, Northolt, Greenford, Middlesex. *(continued)*	C	Wall mounting, free outlet (A) or pressure (B)	12 gal	1 or 1½ kW	White or cream with coloured bands	£23 10 0 (A) £22 10 0 (B)	£5 10 0 (A) £5 5 4 (B)
	D	Wall mounting, free outlet (A) or pressure (B)	15 gal	1½ kW	White or cream with coloured bands	£26 10 0 (A) £25 10 0 (B)	£6 4 1 (A) £5 19 5 (B)
	U.D.B.–20	Floor mounting, pressure (A) or wall mounting, pressure (B)	20 gal	1 kW plus 2 kW	White with blue bands	£29 0 0 (A) £29 15 0 (B)	£6 15 9 (A) £6 19 3 (B)
	U.D.B.–30	Floor mounting, pressure (A) or wall mounting, pressure (B)	30 gal	1 kW plus 2 kW	White with blue bands	£34 10 0 (A) £35 5 0 (B)	£8 1 6 (A) £8 5 0 (B)
	I.S.	Floor mounting, pressure	40 gal	3 kW and 6 kW	White with blue bands	£52 10 0 (3 kW) £60 0 0 (6 kW)	£12 5 9 (3 kW) £14 0 10 (6 kW)
	B.B.T.	Wall mounting, cistern	5 gal	1 kW	White or cream with coloured bands	£22 0 0	£5 3 0
	L.B.T.	Wall mounting, cistern	7½ gal	1 kW	White or cream with coloured bands	£25 0 0	£5 17 0
	C.B.T.	Wall mounting, cistern	12 gal	1 or 1½ kW	White or cream with coloured bands	£28 0 0	£6 11 1
	D.B.T.	Wall mounting, cistern	15 gal	1½ kW	White or cream with coloured bands	£31 0 0	£7 5 1
	U.D.B./B.T.	Wall mounting or floor mounting, cistern	20 gal	2 or 3 kW	White with blue bands	£34 0 0	£7 19 2
	U.D.B./B.T.	Wall mounting or floor mounting, cistern	30 gal	2 or 3 kW	White with blue bands	£39 0 0	£9 2 7
BERRY'S ELECTRIC, LTD., Touchbutton House, Newman Street, London, W.1.	A.Q./3	Sink or basin	3 gal	1 or 2 kW	Green, blue, white or cream, chromium fittings	£11 19 6 (1 kW) £12 9 7 (2 kW)	£2 16 0 (1 kW) £2 18 5 (2 kW)
	A.Q./1½	Sink or basin	1½ gal	750 W or 1 kW	Green, blue, white or cream, chromium fittings	£10 17 7 (750 W) £11 1 3 (1 kW)	£2 10 11 (750 W) £2 11 9 (1 kW)
CREDA (SIMPLEX ELECTRIC, LTD.), Blythe Bridge, Stoke-on-Trent, Staffs.	C142	Single point wall mounting	3 gal	1 kW	White or cream. Pastel shades extra	£11 19 6	£2 16 1
	"Crusader" C143	Single point wall mounting	3 gal	2 kW	White or cream. Pastel shades extra	£11 19 6	£2 16 1
	C5SP	Single point wall mounting	5 gal	1·2 kW	White	£18 10 0	£4 6 7
	C12SP	Single point wall mounting	12 gal	2 kW	White	£26 15 0	£6 5 2
	C20SP	Single point wall mounting	20 gal	2 kW	White	£31 10 0	£7 7 5
	C5MP	Multi-point wall mounting	5 gal	1·2 kW	White	£17 0 0	£3 19 7
	C12MP	Multi-point wall mounting	12 gal	2 kW	White	£23 5 0	£5 8 10
	C20MP	Multi-point wall mounting	20 gal	2 kW	White	£28 0 0	£6 11 0



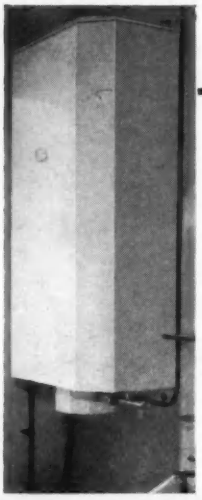
1. *A.E.I.–Hotpoint model NCIA 1½ gal water heater*
2. *Creda "Crusader" 3 gal model*
3. *Berry's model A.Q./3*
4. *Aidas "Two-Plus" 2·2 gal water heater*

Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
CREDA (SIMPLEX ELECTRIC, LTD.), Blythe Bridge, Stoke-on-Trent, Staffs. *(continued)*	" Centrepoint "	Multi-point floor mounting	20 gal	3 kW	White or cream. Pastel shades extra	£27 0 0	£6 6 5
	C20MPF		20 gal	2 kW	White	£42 0 0	£9 16 7
	C30MPF		30 gal	3 kW	White	£51 10 0	£12 1 0
	C5BR	Cistern, rectangular wall mounting	5 gal	1·2 kW	White	£25 0 0	£5 17 0
	C7BR		7½ gal	1·2 kW	White	£29 0 0	£6 15 9
	C12BR		12 gal	2 kW	White	£32 0 0	£7 9 9
	C15BR		15 gal	2 kW	White	£37 0 0	£8 13 2
	C20BR		20 gal	2 kW	White	£38 10 0	£9 0 2
	C5BC	Cistern, cylindrical wall mounting	5 gal	1·2 kW	White	£23 0 0	£5 7 8
	C12BC		12 gal	2 kW	White	£30 0 0	£7 0 5
	C15BC		15 gal	2 kW	White	£33 0 0	£7 14 5
	C20BC		20 gal	2 kW	White	£34 10 0	£8 1 6
	C20BCF	Cistern, cylindrical floor mounting	20 gal	2 kW	White	£52 0 0	£12 3 4
	C30BCF		30 gal	3 kW	White	£60 0 0	£14 0 10
ELTRON (LONDON), LTD., Accrington Works, Strathmore Road, Croydon, Surrey.	S.N.3	Small. Non-pressure under basin	¾ gal	1 kW	White enamel	£11 3 0	£2 10 2
	E.B.5	Overflow wall mounting	1½ gal	2 kW	White enamel	£14 10 0	£3 5 3
	S.N.L.15	Under sink kitchen unit heater	3½ gal	2 kW	White enamel	£32 10 0	£7 6 3
GENERAL ELECTRIC CO. LTD., Magnet House, Kingsway, London, W.C.2.	" Superspeed " Double-two DE.602	Non-pressure (single-point)	2 gal	1·2 kW or 2 kW	White stoved enamel or honeysuckle. Choice of coloured bands	£11 10 0	£2 13 10
	DE.605	Non-pressure (single-point)	5 gal	2 kW	White stoved enamel	£18 10 0	£4 6 7
	DE.610	Non-pressure (single-point)	12 gal	2 kW	White stoved enamel	£26 15 0	£6 5 2
	DE.615	Pressure (multi-point)	15 gal	2 kW	White stoved enamel	£25 10 0	£5 19 4
	DE.730	Pressure (multi-point)	30 gal	3 kW	White stoved enamel	£51 10 0	£12 1 0
	DE.731	Pressure (multi-point)	30 gal	3 kW (d.c.)	White stoved enamel	£53 10 0	£12 10 5
	DE.690	Pressure (multi-point)	20 gal	3 kW	White stoved enamel	£32 0 0	£7 9 9
	DE.726	Cistern	15 gal	1½ kW	White stoved enamel	£39 7 6	£9 4 3
	DE.727	Cistern	20 gal	2 kW	White stoved enamel	£42 10 0	£9 18 11
HEATRAE, LTD., Heatrae Works, Norwich.	" Lido "	Non-pressure	1½ gal *(a)* 2·2 gal *(b)* 3 gal *(c)*	0·75 or 1 kW *(a)* 1 or 1·5 kW *(b)* 1 or 2 kW *(c)*	White or cream body with blue, green, red or black base	£10 12 6 *(a)* £11 0 0 *(b)* £12 9 0 *(c)*	£2 9 9 *(a)* £2 11 6 *(b)* £2 18 3 *(c)*
	D.O.T.	Non-pressure	1½ gal *(a)* 3 gal *(b)*	0·75 kW *(a)* 1 kW *(b)*	White	£13 3 6 *(a)* £16 8 0 *(b)*	£3 1 8 *(a)* £3 16 9 *(b)*
	R.T.A.	Non-pressure	5 gal *(a)* 12 gal *(b)* 15 gal *(c)* 20 gal *(d)* 30 gal *(e)*	1 or 3 kW *(a)* 1·5 or 3 kW *(b)* 1·5 or 3 kW *(c)* 2 or 3 kW *(d)* 3 kW *(e)*	White	£20 17 6 *(a)* £28 13 0 *(b)* £32 3 6 *(c)* £42 4 0 *(d)* £49 10 6 *(e)*	£4 17 9 *(a)* £6 14 2 *(b)* £7 10 8 *(c)* £9 17 6 *(d)* £11 11 10 *(e)*
	U.B.	Non-pressure	2 gal	2 kW	White	£18 18 6	£4 8 7
	S.E.B.	Non-pressure	12 gal	4 kW	White	£31 7 0	£7 6 9
	R.T.	Pressure	5 gal *(a)* 12 gal *(b)* 15 gal *(c)* 20 gal *(d)* 30 gal *(e)*	1 or 3 kW *(a)* 1·5 or 3 kW *(b)* 1·5 or 3 kW *(c)* 2 or 3 kW *(d)* 3 kW *(e)*	White	£19 3 0 *(a)* £26 18 0 *(b)* £30 8 0 *(c)* £40 9 0 *(d)* £47 15 6 *(e)*	£4 9 8 *(a)* £6 5 11 *(b)* £7 2 4 *(c)* £9 9 4 *(d)* £11 3 8 *(e)*

Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
HEATRAE, LTD., Heatrae Works, Norwich. *(continued)*	Table pattern	Pressure	30 gal (a) 40 gal (b)	3 kW (a) 6 kW (b)	White	£96 8 6 (a) £106 1 0 (b)	£22 11 4 (a) £24 16 4 (b)
	" One-Twenty "	Pressure	20 gal	3 kW	White	£30 1 0	£7 0 8
	" One-Thirty "	Pressure	30 gal	3 kW	White	£38 17 6	£9 2 0
	M.A.X.	Pressure	15 gal	2·25 kW	White	£31 2 0	£7 5 7
	G.C.F.	Non-pressure	30 gal (a) 40 gal (b)	3 kW (a) 6 kW (b)	White	£110 5 0 (a) £121 16 0 (b)	£25 16 0 (a) £28 10 0 (b)
	R.T.F.	Pressure	30 gal (a) 40 gal (b)	4·5 kW (a) 6 kW (b)	White	£61 11 6 (a) £92 10 0 (b)	£14 8 3 (a) £21 12 11 (b)
	F.B.	Non-pressure	5 gal (a) 12 gal (b) 15 gal (c) 20 gal (d) 30 gal (e)	1 or 3 kW (a) 1·5 or 3 kW (b) 1·5 or 3 kW (c) 2 or 3 kW (d) 3 kW (e)	White	£31 15 0 (a) £42 5 0 (b) £47 13 0 (c) £58 4 6 (d) £68 12 6 (e)	£7 8 7 (a) £9 17 9 (b) £11 3 0 (c) £13 12 6 (d) £16 1 2 (e)
	R.B.	Non-pressure	12 gal (a) 15 gal (b) 20 gal (c) 30 gal (d)	1·5 or 3 kW (a) 1·5 or 3 kW (b) 2 or 3 kW (c) 3 kW (d)	White	£42 5 0 (a) £47 13 0 (b) £58 4 6 (c) £68 12 6 (d)	£9 17 9 (a) £11 3 0 (b) £13 12 6 (c) £16 1 2 (d)
	R.B.F.	Non-pressure	30 gal (a) 40 gal (b)	4·5 kW (a) 6 kW (b)	White	£72 16 6 (a) £104 6 6 (b)	£17 0 10 (a) £24 8 3 (b)
MITCHELL ELECTRIC, 88-90, Tennant Street, Birmingham, 15.	" Streamline "	Non-pressure	1½ gal	750 W	White, cream, blue or green	£10 19 6	£2 11 5
	" Streamline "	Non-pressure	2 gal	1 kW	White, cream, blue or green	£11 5 6	£2 12 9
	" Streamline "	Non-pressure	3 gal	1 kW	White, cream, blue or green	£11 11 0	£2 14 0
RADIATION, LTD., Electrical Division, 255, North Circular Road, London, N.W.10.	Jackson " Jill " 921	Non-pressure	1½ gal	0·75 or 1 kW	All white or cream or base plate cover in blue or eau-de-nil	£10 5 0	£2 8 0
	Jackson " Jill " 923	Non-pressure	3 gal	1 or 2 kW	All white or cream or base plate cover in blue or eau-de-nil	£11 0 0	£2 11 6

5. *Heatrae " Lido " water heater*
6. *G.E.C. " Superspeed Double-two " 2 gal water heater*
7. *Creda " Centrepoint " 20 gal floor mounting model*
8. *G.E.C. model DE.690 dual heat model*

Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
SANTON, LTD., Somerton Works, Newport, Mon.	FB21	Non-pressure, wall mounting	2·6 gal	1·2 kW	White or cream	£11 17 6	£2 15 7
	NPT/1½/E		1½ gal	1·2 kW	White	£10 10 0	£2 9 2
	NPT/3/E		3 gal	1·2 kW	White	£11 15 0	£2 15 0
	NPT/5/E		5 gal	1·2 kW	White	£19 5 0	£4 10 1
	NPT/12/E		12 gal	2 kW	White	£26 15 0	£6 5 2
	NPT/15/E		15 gal	2 kW	White	£28 10 0	£6 13 5
	NPT/20/E		20 gal	2 kW	White	£31 10 0	£7 7 5
	NPT/2½/FM	Non-pressure, floor mounting	2½ gal	1 kW	White	£20 15 0	£4 7 1
	PT/5/E	Pressure, wall mounting	5 gal	1·2 kW	White	£17 17 0	£4 3 7
	PT/12/E		12 gal	2 kW	White	£23 5 0	£5 8 10
	PT/15/E		15 gal	2 kW	White	£25 10 0	£5 19 4
	PT/20/E		20 gal	2 kW	White	£28 0 0	£6 11 0
	PT/2½/FM	Pressure, floor mounting	2½ gal	1 kW	White	£17 5 0	£4 0 9
	PT/20/EFM		20 gal	2 kW	White	£42 0 0	£9 16 7
	PT/30/EFM		30 gal	3 kW	White	£51 10 0	£12 1 0
	DF/5/E	Cistern, wall mounting, cylindrical	5 gal	1·2 kW	White	£24 0 0	£5 12 7
	DF/12/E		12 gal	2 kW	White	£30 0 0	£7 0 5
	DF/15/E		15 gal	2 kW	White	£33 0 0	£7 14 5
	DF/20/E		20 gal	2 kW	White	£34 10 0	£8 1 6
	DF/5/ER	Cistern, wall mounting, rectangular	5 gal	1·2 kW	White with black top and base	£25 0 0	£5 17 0
	DF/7½/ER		7½ gal	1·2 kW		£29 0 0	£6 15 9
	DF/12/ER		12 gal	2 kW		£32 0 0	£7 9 9
	DF/15/ER		15 gal	2 kW		£37 0 0	£8 13 2
	DF/20/ER		20 gal	2 kW		£38 10 0	£9 0 2
	DF/30/EFM	Cistern, floor mounting	20 gal	3 kW	White	£52 0 0	£12 3 4
	DF/30/EFM		30 gal	3 kW	White	£60 0 0	£14 0 10
	"Monmouth"	Automatic dual, floor mounting	12 gal (*a*) and 20 gal (*b*)	3 kW	White	£29 0 0 (*a*) £32 0 0 (*b*)	£6 15 9 (*a*) £7 9 9 (*b*)
W. H. SMITH (EZIOT), LTD., 32, Mansfield Street, Church Gate, Leicester.	"Eziot" WT	Non-pressure	1½ to 20 gal	750 W to 2 kW	Cream or white	£10 10 0 to £44 0 0	£2 9 2 to £10 5 11
	"Eziot" PWT	Pressure	3, 5 and 12 gal	1 and 1½ kW	Cream or white	£11 15 0 to £26 0 0	£2 15 0 to £6 1 8
	"Eziot" BWT	Built-in cistern	3 to 20 gal	1 and 2 kW	Cream or white	£24 0 0 to £43 15 0	£5 12 4 to £10 4 9
	"Eziot" UWT	Under-basin	1½, 3 and 5 gal	1 and 2½ kW	Cream or white	£12 10 0 to £21 15 0	£2 18 6 to £5 1 9
	"Eziot" UDB	"Dulec"	20 gal (*a*) and 30 gal (*b*)	3 kW	Cream or white	£31 0 0 (*a*) £36 10 0 (*b*)	£7 5 1 (*a*) £8 10 10 (*b*)



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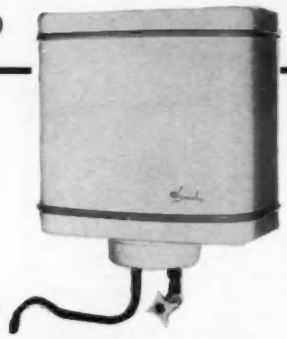

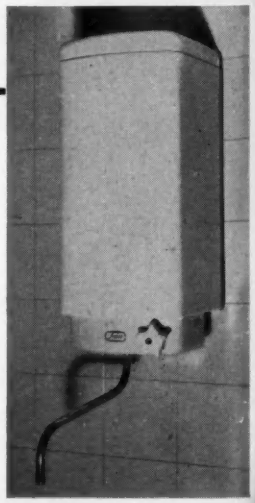

9. *W. H. Smith "Eziot" type BWT cistern model*

10. *Santon model FB.21 2·6 gal water heater*

11. *Jackson "Jill" 3 gal model (Electrical Division of Radiation, Ltd.)*

MAIN LINE ELECTRIFICATION

First Passenger Train Electric Locomotive

The a.c. electric locomotive shown making its first run with a passenger train over the first portion of the London Midland Region line to be electrified. The locomotive will normally be used for training drivers and testing equipment

LAST week, a British Railways' passenger train was hauled for the first time by an a.c. electric locomotive. The special run was over the 9½ miles stretch between Wilmslow and Mauldeth Road on the London Midland Region main line. The locomotive used was originally powered by a gas turbine which has been converted by Metropolitan-Vickers. It will normally be used only for the training of drivers and the testing of equipment until completion of the electrification of the 31 miles between Crewe and Manchester and the delivery of electric locomotives now on order.

Some 206 instructors and motor men are to be trained and guards will also be instructed on multiple unit trains. As the Crewe-Manchester multiple unit trains will not be available until the second half of 1959, four trains that are being built for the London-Tilbury-Southend electrification are being loaned to the London Midland Region for the training of electric motor men. The London Midland Region trains on order will be identical with those, apart from the electrical equipment.

These units are being built at York and Doncaster and equipped with English Electric traction equipment and Westinghouse brake gear. They are assembled into four-car sets and can be driven from either of the two cabs which are situated one at each end. Each cab contains a master controller interconnected by 36-way control jumpers. Mounted on the specially lowered roof of the guard's van on the motor coach, is a Faiveley pantograph and a Brown Boveri air-blast circuit-breaker. The former collects power from the overhead line and supplies it to the main transformer mounted on the under-frame in the centre bay. This is capable of taking power at either 25 or 6·25 kV and supplies the mercury arc rectifiers also on the under-frame. The motor coaches are each powered by four axle nose-suspended traction motors continuously rated at 232 h.p. and driving on to 40in road wheels. The cubicles which contain the various control gear are also mounted on the motor coach under-frame.

The first stage of the electrification of the Euston-Manchester-Liverpool main lines by the 25 kV a.c. single-phase overhead system, comprising 31 route miles between Crewe and Manchester, is scheduled to be completed by the autumn of 1960. On this section of track some 88 bridges have had to be reconstructed, tunnels opened out, a new signalling system installed, stations rebuilt and platforms lengthened.

For the Crewe to Manchester service 42 type A locomotives and 15 multiple unit trains are being provided. The 3,300 h.p. locomotives are of the Bo-Bo type weighing 80 tons and they are capable of a maximum speed of 100 m.p.h. The maximum speed of a multiple unit train is 75 m.p.h.

The section of line between Wilmslow and Slade Lane Junction via Styale has been used as a pilot scheme. The re-signalling of this section of line was described in our issue of 5th September. The signal alterations at Crewe were completed on 17th November and the controls transferred to Crewe North junction boxes.

NUCLEAR POWER ECONOMICS

IN delivering the Sir Charles Parsons Memorial Lecture to members of the Institute of Marine Engineers on 26th November, Sir John Cockcroft (U.K. Atomic Energy Authority) said that the date at which nuclear power was forecast to break even with commercial power varied greatly between different countries. That was understandable since in the United States a great deal of power was generated from cheap Kentucky coal, natural gas and hydro plant.

Load factors, capital charges and power costs varied greatly from country to country, and the price of enriched uranium fuel was another important variable parameter. In a paper presented at the recent Geneva conference it was stated that Hinkley Point nuclear station in Somerset would just about break even with coal-fired stations on a load factor of 75 per cent, a write-off of 20 years and interest rates of 5 per cent. Reductions in capital costs due to straightforward developments and improvements in technology of the order of 30 per cent were foreseen over the succeeding five years.

In Italy a World Bank study of various types of nuclear power stations concluded that, with the Italian 14 per cent capital charges, an 80 per cent load factor and oil at £9 10s per ton, nuclear power would start by being 10 per cent above commercial power costs for stations completed in 1964. United States speakers predicted that in the United States nuclear power would not be competitive with conventional stations until about 1972. The Russians gave very little information about economics, and in other countries the break-even dates lay between those of the United Kingdom and the United States.

Sir John Cockcroft devoted a great part of his lecture to a discussion of types of reactor which might have an application to marine engineering.

Financial Section

STOCKS and SHARES

THERE was a sharp reminder, towards the end of the past month, of the importance of Wall Street's behaviour as an influence on the London stock market. Prices of industrial shares became decidedly flat for a time when the American market went into reverse with a suddenness striking enough to warrant front-page reporting. An equally agile recovery almost completely restored the situation, but left markets noticeably more sensitive than usual to the news which begins each day to come in from Wall Street at about the time that our own Stock Exchange is officially closing. Government stocks have retained fairly well the benefit from the latest Bank Rate reduction.

Irregular Changes

Effects of the sharp changes in the trend of the industrial market produced a mixture of net gains and losses in the lists of share prices. G.E.C. and A.E.I. made particularly lively recoveries to 36s 3d and 58s 9d respectively, after earlier setbacks. English Electric were little changed on balance, but Crompton Parkinson and Parsons lost some ground. In the cable group, London Electric Wire lost a further 2s 6d of the previous advance, receding to 60s, while J. & P. and Enfield were also easier. The Electronic Computer Exhibition stimulated interest in some shares, among which British Tabulating Machine were conspicuously well supported up to 62s. Elliott Automation continued to reflect some disappointment over the recent interim statement. Cossor were marked up 6d to 6s, and improvements were noted in Decca, Pye, Greenwood & Batley, Dewhurst and others. British Aluminium first bounded up from under 60s to 77s, then reacted to 68s 9d, as news came through about proposals affecting the future of the company.

Philips Lamps Progress

There were some very sharp fluctuations in the price of Philips Lamp Works shares in response to Wall Street's changes of direction, but the price quickly regained its upward course, reaching 68s 6d, after publication of the company's trading figures for the third quarter of the year. A further big expansion in that period brought the value of sales, for the first nine months of the year, to a total 12 per cent above the corresponding level in 1957. By the same comparison, profits increased by 28 per cent (or by 24 per cent after tax), indicating that in the matter of profit margins the group's experience has been uncommonly favourable. On the basis of last year's rate of dividend the shares of Fl.10 show a yield of a little under 3½ per cent.

Interim Dividends

Increased interim dividends have been declared by Berry's Electric

Price Changes in

Company or Board	Nom. Value	Middle price 1st Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	76½		3	3	3 18 6	76½	72
Brit. Elec. 1974/77	100	73½		3	3	4 1 9	73½	68½
Brit. Elec. 1976/79	100	77		3½	3½	4 10 9	78½	72
Brit. Elec. 1974/79	100	87½		4½	4½	4 17 3	87½	82½
Overseas Electric Supply								
Calcutta Elec.	£1	17/6		6·8†	7†	8 0 0†	17/6	15/-
East African Power	£1	22/9		7½	8	7 0 3	23/-	17/6
Nigerian Elec.	£1	14/6		10	10	13 16 0	17/-	12/6
Perak Hydro-Elec.	£1	13/6		12½	10	14 16 3	15/6	13/6
Electrical Shares								
Aberdare Holdings	5/-	15/6		17½	17½	5 13 0	15/6	9/9
Aerialite	1/-	7/9	−9d	51½	54	6 19 0	8/6	5/1
Allen, W. H.	£1	43/9		10	11	5 0 6	43/9	32/9
Anglo-Portuguese Tel.	£1	26/9	−6d	8	9	6 14 6	29/3	19/9
Aron Elec. Ord.	£1	61/3		15	15	4 18 0	61/3	53/-
Assoc. Elec. Ord.	£1	58/9x.d.	+1/6	15	15	5 2 3	58/9	46/6
Automatic Tel. & El.	£1	72/6		17	17	4 13 9	72/6	57/-
Babcock & Wilcox	£1	51/3	−2/6	15	13‡	5 1 6	54/6	41/9
Bakelite	10/-	21/3		15	15	7 1 3	23/-	17/6
Baldwin, H. J.	2/-	3/-		20	20	—	3/9	2/6
Berry's Electric	5/-	10/-	−6d	10	10	5 0 0	10/6	5/9
Bowthorpe Holdings	2/-	11/-		37½	25*	4 11 0	11/-	6/6
British Aluminium	£1	68/9	+9/6	12	12	3 9 9	77/6	37/-
Brit. Elec. Traction: Def. Ord. "A"	5/-	38/6		25	25	3 5 0	40/-	19/6
B.I. Callender's	£1	50/-x.d.		12½	12½	5 0 0	52/-	38/9
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	20/3	19/-
British Tabulating	£1	62/-	+2/-	9	10	3 4 6	62/-	38/6
British Thermostat	5/-	34/9		25	30	4 6 3	35/3	19/9
British Vac. Cleaner	5/-	4/3	−3d	10	10	5 17 9*	4/6	2/3
Brook Motors	10/-	43/9		25	25	—	43/9	27/9
Bulgin, A. F.	1/-	7/-		40	45	6 8 6	7/-	4/7
Bulpitts	5/-	10/6		—	12½‡	5 19 0	10/6	7/3
Burco Dean	5/-	11/9	+3d	20	22½	6 7 9*	11/6	7/9
Cable & Wireless: Ord.	5/-	12/6	−6d	10	10‡*	4 0 0	13/-	8/-
4% Loan	100	94½		4	4	4 4 9	94½	89
Chloride El. Storage "A"	£1	65/9	−6d	17½	17½	5 6 6	66/3	55/6
Clarke Chapman	£1	64/3		27½	27½	4 5 6	72/6	55/-
Cole, E. K.	5/-	16/3	−6d	17½	17½	5 7 9	18/-	15/3
Cossor, A. C.	5/-	6/-	+6d	2½	Nil	Nil	6/-	4/4
Crabtree	10/-	31/6		20	20	6 7 0	32/-	24/4
Crompton Parkinson	5/-	11/6	−1/-	16	12*	5 4 3	13/6	8/3
De La Rue	10/-	31/3x.d.	−6d	35	17½*	5 12 0	32/3	20/9
Decca "A"	4/-	34/3	+6d	43½	43½	5 2 3	34/6	21/3
Desoutter	5/-	17/-	+6d	32½	18½*	5 10 3	17/-	13/6
Dewhurst	2/-	9/3	+6d	16½	20	4 6 6	9/3	6/9
Dictograph Tel.	2/-	7/-		20	20	5 14 3	7/3	4/7
Dubilier Condenser	1/-	3/6		30	20*	5 14 3	4/3	3/1
Duport	5/-	10/ x.d.	−6d	25	12½*	6 5 0	10/9	7/9
E.M.I.	10/-	57/3	+6d	15	15	—	54/-	27/6
Electrical Components	5/-	9/3		12½	12½	6 15 3	9/9	7/-
Elec. Construction	£1	27/6	−1/3	8½	8½	6 3 9	28/9	21/-
Elliott-Automation	5/-	17/9x.d.	−3d	—	10‡	2 16 3	19/9	11/6
Enfield Cable Ord.	£1	16/6	−6d	Nil	2½	3 0 6	18/9	10/9
English Electric	£1	58/9		14	14	4 15 3	60/-	44/-
English Electric 3½% Pref.	£1	12/6		3½	3½	6 0 0	12/6	11/9
Ericsson Tel.	5/-	25/9		22†	12*‡	4 1 0	25/3	17/6
Ever Ready	5/-	22/-	+3d	37½	20*	4 11 0	22/-	13/9
Falk Stadelmann	£1	42/6	−1/3	17½	15	7 1 3	46/3	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

Magicoal and Ada (Halifax), both of which make up their accounts to the end of March. In the case of Berry's the increase is from 4 to 5 per cent. Dividends totalling 10 per cent were paid in the two years following the marketing of the shares in 1956. After a recession of earnings in 1957–58, the annual report issued in the middle of this year announced a marked improvement in sales, with assistance from the purchase-tax reductions and the easing of the credit squeeze. The 5s shares are quoted at 10s. Ada (Halifax) have distributed totals of 17½ per cent for the last two years, and are now putting up the interim payment from 7½ to 10 per cent. The 1s shares stand at about 2s 6d.

Electrical Investments

Company or Board	Nom. Value	Middle price 1st Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Electrical Shares—continued						£ s d		
G.E.C. Ord.	£1	36/3	+1/3	12½	10	5 10 3	40/-	29/3
G.E.C. 6½% Pref.	£1	21/-x.d.		6½	6½	6 3 9	21/6	20/3
General Cables	5/-	9/3	−6d	30	24	—	11/9	8/3
Greenwood & Batley	£1	57/6	+2/6	17½	20	6 19 3	57/6	45/-
Hackbridge Holdings	5/-	13/9		20	20	7 5 6	14/9	7/6
Hackbridge & Hewittic	5/-	13/6x.d.	−3d	20	20	7 8 3	14/6	9/7
Head Wrightson	5/-	24/-	−1/-	22½	17½*	3 13 0	26/-	16/9
Heatrae	2/-	7/6		15	20	5 6 9	7/6	4/-
Holophane	5/-	15/6		37½	22½*	7 5 3	15/6	12/6
Hoover	5/-	53/-	+1/-	50	50	4 14 3	53/6	31/-
I.C.I.	£1	36/3	+9d	10	12	4 8 3*	36/6	23/9
Intl. Combustion	5/-	27/6	−1/-	22½	25	4 11 0	28/3	19/3
Johnson & Phillips	£1	17/6	−1/3	10	5	5 14 3	25/-	15/-
Lancashire Dynamo	£1	43/9		11	11	5 0 6	43/9	28/6
Laurence Scott	5/-	16/3	−6d	15	15	4 12 3	16/9	12/6
Lister, R. A.	£1	31/-	−6d	10	10	6 9 0	31/6	23/-
London Elec. Wire	£1	60/-	−2/6	12½	12½	4 3 3	64/6	39/6
Lucas, J.	£1	42/6		7½	10‡	4 14 3	45/-	27/9
Marconi Marine	£1	38/9		10	10	5 3 3	38/9	29/-
Marryat & Scott	2/-	7/6	+6d	35	37½	5 0 0*	7/7	5/3
Mather & Platt	£1	50/6		15	15	3 19 3*	50/-	29/6
Metal Industries	£1	41/-	−2/3	9	14	6 16 6	44/-	22/9
Midland Elec. Mfg	£1	37/6x.c.		12½	12½	—	62/6	44/-
Morphy-Richards	4/-	17/6		20	20	4 11 6	19/-	14/6
Murex	£1	53/3	+9d	20	17½	6 11 6	59/3	48/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/-	2/3
Parsons, C.A.	£1	52/6	−2/6	8½	7½*	2 17 3	55/-	43/-
Plessey	10/-	65/-x.d.	−1/6	30	30	4 12 3	72/6	55/-
Pye	5/-	16/-	+6d	12½	12½	3 18 3	17/-	10/-
Pyrotenax	5/-	32/3	−3d	—	27½‡	4 5 3	33/9	27/6
Reyrolle	£1	88/9		17½	17½	3 19 0	88/9	73/6
Rheostatic	4/-	7/6		12½	12½	6 13 3	8/-	6/-
Richardsons Westgarth	10/-	14/9		16¾	8½*	5 13 0	15/9	13/-
Scottish Cables	4/-	11/9		27½	27½	5 8 9*	11/9	7/-
Simon-Carves	5/-	31/3	+9d	20	25	4 0 0	31/3	22/6
Smith (England), S.	4/-	11/-		20	12½*‡	4 11 0	12/3	7/-
Southern Areas	£1	12/6		7½	Nil	Nil	13/9	9/3
Strand Elec.	5/-	9/-		15	15	8 6 9	9/3	4/9
Sturtevant	5/-	17/6	−9d	15†	15†	7 9 0	19/6	14/9
Sun Elec.	£1	60/6		25	25	8 5 3	60/6	47/3
Switchgear & Cowans	5/-	8/9		25	22½	6 8 6*	8/9	4/6
Taylor Tunnicliff	5/-	17/9	+6d	15	17½	4 18 6	17/9	11/9
T.C.C.	10/-	37/6		25	25	6 13 3	38/6	32/6
T.C. & M.	£1	32/6		8½	8½‡	5 4 6	32/6	20/-
Telephone Mfg.	5/-	4/3x.d.		10	10	11 15 3	5/9	4/3
Telephone Rentals	5/-	12/6	−3d	12½	12½	5 0 0	13/6	9/9
Thompson (John)	5/-	25/-		25	25	5 0 0	27/-	23/-
Thorn Elec. "A"	5/-	23/3		17½	17½	3 15 3	23/3	17/-
Thornycroft	£1	23/9		12½	7½	6 6 3	30/9	21/-
Tube Investments	£1	77/6		15	17½	4 10 3	78/9	48/3
Vactric	5/-	28/6	+2/3	25	25	4 7 9	—	—
Veritys	5/-	5/3		12½	2½	2 7 6	6/9	5/3
Walsall Conduits	4/-	17/9		20	22½	5 1 6	17/9	11/-
Ward & Goldstone	5/-	34/-x.d.		40	25*	3 13 6	34/6	23/6
Watford	2/-	7/6		25	25	5 6 9*	7/6	4/-
Westinghouse	£1	42/6	−1/3	18	10*	4 14 3	43/9	32/3
West, Allen	5/-	12/6	−3d	15	12½*	—	13/-	7/9
Wolf Electric	5/-	7/3	−1/-	20	10*	6 18 0	9/-	6/9

Vactric Dividends

Holders of Vactric 5s shares have reason to be well pleased with the course of recent events. Having just received the special and tax-free distribution of 8s 6d per share out of the company's £1 million profit on the sale of its hire-purchase subsidiary, they are informed now of an increase in the normal interim dividend for the current year from 10 to 12½ per cent, also of a proposed one-for-nine scrip issue and the prospect of a record turnover and profits for the twelve months ending next March. In the company's statement the provisionally calculated profit of £230,000, before tax, for the six months to September last, is said to be at an annual rate well in excess of the previous year's figures, and it does not include income received from the subsidiary which has now been sold. These items of news have been reflected in a further rise in the price of the shares to 28s 6d.

Commercial Television

Activity in shares with commercial television associations has been well maintained since the announcement of a £5·1 million trading profit for 1957–58, and an interim dividend on account of the current year, by Associated-Rediffusion, the London mid-week programme contractors. Of this company's equity capital, half is understood to be held by British Electric Traction and 37½ per cent by Rediffusion (in which B.E.T. also has a large interest). The shares of these two companies have been quoted lately at 38s 6d (for the "A" shares) and 35s 3d respectively. Both stood at around 20s earlier this year.

Metal Industries Interim

Having nearly doubled in value during the course of this year, the £1 shares of Metal Industries have been a little less buoyant, at around 41s, since the issue of the company's interim statement covering the first twenty-eight weeks of the financial year ending next March. Profits of £679,000 (before tax) in that period compared with £811,000 in the corresponding weeks of the previous year, for the whole of which there were record earnings of £1¾ million. It is emphasised that the interim figures are provisional and not necessarily representative of the whole year, and there is a reminder that last June the company sold its investment in British Oxygen ordinary stock on which the interim dividend, amounting to £60,000, was not consequently received. In September the company announced the acquisition, for a consideration of £800,000, of Towler Brothers.

REPORTS and DIVIDENDS

Crabtree Electrical Industries, Ltd.—The main figures in the accounts for the year ended 31st July last were given in our issue of 14th November. In his statement, which has been circulated with the report and accounts, Mr. J. A. Crabtree (chairman) says that the year under review has been a difficult one for the industry. The sudden increase in bank rate resulted in a decline in the building and machine tool industries at home and in addition there has been increased competition in export markets and in certain cases a tightening of import restrictions. These factors combined with the already existing tendency to smaller margins are responsible for the drop in profit as compared with the previous year. Referring to research, Mr. Crabtree mentions the new test station which was opened in September. They have introduced a new range of domestic and industrial accessories, which they have called "Closegang," since they are more compact than any which they have offered previously; this range has been well received by the trade. Their development of the new market for small circuit-breakers is beginning to show interesting results.

The report includes an illustrated description of the company's new test station.

Vent-Axia, Ltd., reports that the profit of the group, before taxation, and subject to audit, for the half-year to 30th September last is approximately £97,610, as compared with £127,834 for the corresponding period of the preceding year. The interim ordinary dividend is maintained at 10 per cent. It is stated that the domestic, office and industrial fan business of Vent-Axia enjoyed a satisfactory half-year's trading. That of Axia Fans, producing marine fans, was adversely affected during removal from the old works to the new factory at Crawley and invoicings were lower. The move has now been completed, but it is doubtful whether overall results for the full year ending 31st March next can reach the high level attained in the previous year.

Metal Industries, Ltd., announce an interim dividend of 4 per cent (unchanged). In his mid-year report, Sir Charles Westlake (chairman) says that the results for the 28 weeks ended 11th October last show a profit before taxation of £679,000, as compared with £719,000 for the first 24 weeks and £811,000 for the first 28 weeks of the financial year 1957-58. This interim statement covers 28 weeks rather than the 24 weeks previously adopted. He emphasises that the results are provisional and are not necessarily representative of the whole year. Current conditions have adversely affected certain of the companies in the Metals Division. The first half of the year was barely affected by the recent wages award in the engineering and shipbuilding trades; this award will find reflection in the results for the remainder of the year. The sale in June of the substantial holding of ordinary stock in the British Oxygen Co., Ltd., has had the effect, during the period under review, of losing to the company the interim dividend, amounting to £60,000 before tax, the benefit of which was passed on to stockholders. Nothing is included in the results in respect of Towler Brothers (Patents), Ltd., for which the group paid £800,000 last September. It was indicated at that time that Towlers' profits were running at around £140,000 a year.

The British Aluminium Co., Ltd., announced last week that it had entered into an agreement with the Aluminum Company of America ("Alcoa") whereby the American company agreed, subject to Treasury consent, to subscribe for the 4,500,000 unissued ordinary shares of British Aluminium on terms which would ensure the finance which the British company needed during the next few years. The British nature of the company would be maintained. While consents to the contract were awaited an offer was received from Tube Investments, Ltd., in association with Reynolds Metals (large American producers of aluminium) to purchase the whole of the issued capital of British Aluminium; control would be retained in British hands. The British Aluminium board said that the conditions attached to the offer that there should have been no material change in the company's issued capital and no contracts entered into other than in the ordinary course of business were not fulfilled, in view of the contract with Alcoa. For this reason the offer could not be transmitted to the shareholders.

Belliss & Morcom, Ltd., are paying an interim dividend of 4 per cent (unchanged).

The Hawker Siddeley Group, Ltd.—The trading profits of the United Kingdom group for the year ended 31st July last amount to £8,574,404, as compared with £8,683,890 for the preceding year. From this is deducted special development expenditure of £2,886,203, and taxation of £3,877,075, and after making credit adjustments, etc., the net balance is £3,221,106 (against £4,700,674). To this is added a balance of £1,897,495 from the Canadian group, and the total available to the Hawker Siddeley Group is £5,118,601 (£7,115,584). Sums totalling £3,392,267 are retained in subsidiaries, leaving £1,726,334 (£1,750,290) available. It is proposed to pay a final dividend of 7 per cent, making 10 per cent for the year (unchanged), and £73,531 is added to undistributed profits.

The Lisbon Electric Tramways, Ltd., has declared an interim dividend of 2 per cent, tax free (unchanged).

Senior Economisers, Ltd., has declared an interim dividend of 25 per cent (unchanged).

The Harland Engineering Co., Ltd., has declared an interim ordinary dividend of 4 per cent (unchanged).

Bakelite, Ltd., has announced an interim dividend of 5 per cent (unchanged).

Berry's Electric Magicoal, Ltd., is paying an interim dividend of 5 per cent (against 4 per cent).

The London Electrical & General Trust, Ltd., has declared an interim dividend of 4 per cent (unchanged) on larger capital.

Newton Brothers (Derby), Ltd., propose to make a one-for-two free scrip issue.

New Companies

H. Burton (Stoke-on-Trent), Ltd.—Registered 29th October. Capital £6,000. Electrical engineers and contractors, etc. Directors: H. S. Day, Mrs. Laura A. B. Day, F. P. Jones and Mrs. Bessie Jones. Regd. office: 16, Liverpool Road, Stoke-on-Trent.

Border General Electrical Services (Saltney), Ltd.—Registered 29th October. Capital £1,000. Electrical engineers, etc. Directors: G. Shone and F. Shone. Regd. office: 71, Chester Street, Saltney, Chester.

Albert A. Spencer, Ltd.—Registered 15th October. Capital £1,000. Manufacturers of and dealers in, hirers and repairers of electrical goods, radio and television receivers, components, etc. Directors: A. A. Spencer and Mary Spencer. Regd. office: 41/43, New York Street, Leeds, 1.

Ideal Home Appliances (North Wales), Ltd.—Registered 24th October. Capital £1,000. Manufacturers of and dealers in electrical home appliances, radio and television equipment of all kinds, television and radio engineers, etc. Directors: G. O. A. Roberts and C. Lawton. Regd. office: Celtic House, Colwyn Avenue, Rhos-on-Sea, N. Wales.

Don Electric Co., Ltd.—Registered 5th November. Capital £3,000. Electrical engineers and contractors, etc. Directors: D. Gill and Mrs. Rita M. Gill. Regd. office: 59, Netherhall Road, Doncaster.

Bankruptcies

B. Young, lately carrying on business at 16, Curzon Street, London, W.1, as a wholesale dealer of electrical fittings.—Trustee, Mr. G. F. Morris, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver, released 13th November.

H. C. Kinsley, formerly carrying on business as an electrical engineer and contractor under the style of North Lincs. Electrical Installations, at 20, Waterloo Street, and 42, Queen Street, Market Rasen, Lincs., formerly residing and carrying on business under the same style and under the style of the Race Course Filling Station at 74, Willingham Road, Market Rasen.—Last day for receiving proofs for dividend 5th December. Trustee, Mr. E. C. Stimpson, 27, Regent Street, Park Row, Nottingham, Official Receiver.

H. Smith, lately carrying on business as an electrical engineer at The Old Bakery, South Clifton, Notts.—Last day for receiving proofs for dividend 5th December. Trustee, Mr. N. Temple, 185, High Street, Lincoln.

E. G. Phillips, 39, Carrs Lane, Birmingham, 4, electrical engineer.—First and final dividend of 5s 10½d in the £, payable on and after 9th December at 126, Colmore Row, Birmingham, 3.

GENERATION and DEVELOPMENT

Revised M.D. Tariffs

Brief details were given in last week's issue of the revised domestic tariff and commercial and industrial block rates which are to come into operation in the Merseyside and North Wales Electricity Board's Area next year. It was also indicated that the maximum demand tariffs were being reshaped following the changes in the bulk supply tariff. Under the m.d. tariffs the annual charge per kW is to be increased by 28s and "unit" charges reduced by 0·05d (medium voltage) or 0·045d (high voltage). The incremental charge in the fuel adjustment clause of the tariffs is also being reduced. Consumers with low load factors will therefore pay more and those with high load factors less, the overall effect being an increase in revenue to the Board of less than 1 per cent under the m.d. tariffs. It is pointed out that more than a year ago the Consultative Council agreed that increased tariffs were necessary. In support of the policy of checking inflation, however, the proposed increases were deferred. The new tariffs to come into force next year are designed to produce £500,000 a year less than those originally agreed with the Consultative Council.

Off-Peak Heating in South Scotland

In a paper presented at the recent conference held in conjunction with the Electro-Heat and Productivity Exhibition at the Kelvin Hall, Glasgow, Mr. W. Stevenson (South of Scotland Electricity Board) said that there were now 900 dwellings in the Board's area in which under-floor heating had been installed. A further 2,000 were under construction and many more were in the design stage. In addition, 20 schools were equipped with electrical floor warming and 16 more were under construction. He also referred to installations of this type in the Bathgate Fire Station, office blocks, factories and brickworks. A firm of engineers had recently completed a large extension to their premises and had installed underfloor warming. The comfort conditions were of such a high standard that the workers had asked the management to extend this type of heating throughout the factory.

District Line Modernisation

The first major stage in London Transport's £2½ million scheme to modernise the eastern section of the District Line will be completed on 1st December, when part of the new depot at Upminster is brought into use. This depot, costing £1 million, has some four miles of track and will accommodate 34 eight-car trains. It has a main car shed 450ft long with nine inspection roads and a 215ft-long lifting shop. Train movements into and out of the depot will be directed from a 40ft control tower equipped with "talk-back" apparatus. Instructions from the tower will be heard by the train driver concerned, and no one else, through a trackside loudspeaker. The driver's acknowledgment can be given at ordinary speech level and will be picked up by a trackside microphone and relayed back to the control tower. Forty 1,000 W floodlights on two 150ft masts will light the depot tracks at night.

The new depot replaces the present one between East Ham and Barking, the site of which is required by the Eastern Region of British Railways in connection with the electrification of the Fenchurch Street-Southend Line.

In addition to the new depot, the 12½ miles of the District Line from Bow Road to Upminster are now being completely re-equipped with London Transport's standard signalling, replacing equipment due for renewal after many years' service.

Contact Wire Erection on Southend Line

An important stage in the electrification of the London, Tilbury and Southend line was reached recently when, between Hornchurch and Upminster, the first section of the overhead contact wire was suspended above the tracks. A special wiring train of six coaches is in use, fluorescent lighting being installed on the roof to permit working at night.

The modernisation scheme for the London, Tilbury and Southend line provides for the introduction of electric traction over nearly eighty route miles, covering the lines between Fenchurch Street and Shoeburyness, Barking and Pitsea via Tilbury and between Upminster and Grays. The British Transport Commission standard overhead high voltage 50 c/s system is being used, and the work is scheduled to be completed in 1961.

OVERSEAS

New 330 kV Network for Sydney

The N.S.W. Electricity Commission is to establish an outer 330 kV transmission ring around the metropolitan area of Sydney to meet the constantly increasing demand for electricity. Key points in this outer ring will be three major distribution centres which will receive large blocks of power from the Commission's new generating stations in the coalfields as well as from the Snowy Mountains hydro-electric scheme. Step-down transformers at these centres will feed the power into an integrated 132 kV system, the nucleus of which has already been established.

The three 330 kV distribution centres will be known as Sydney North, Sydney West and Sydney South. They will be remote-controlled and established in garden settings. Each centre will occupy about 30 acres and cost in the region of £3 million. The Commission plans to have Sydney South operating in 1961, Sydney North in 1963 and Sydney West in 1966. The new 132 kV substations will cost about £750,000 each.

Christmas lighting in Regent Street, London, showing 7ft lanterns around which translucent stars revolve, is attracting large crowds of Christmas shoppers

Progress of Laxapana Project

Work on Stage IIA of the Laxapana hydro-electric scheme in Ceylon is now complete and tenders have been invited for a part of Stage IIB, namely the steam station at Grandpass. The closing date for tenders is 3rd February, 1959. The International Bank for Reconstruction and Development has agreed to make a loan of $7·4 million for this section of the project. The Bank has also agreed to a proposal that tenders should be invited for the hydro-electric development at Norton Bridge but is to send a mission to Ceylon before the loan for the hydro part is approved.

Spanish Railway Modernisation

The Spanish State Railways (RENFE) have issued details of a new five-year plan for the modernisation of their tracks, rolling stock and other equipment, at a cost of 24,700 million pesetas (£209 million). This represents only about a third of the cost of the plan, which has had to be reduced. The main emphasis is to be on track improvements, electrification and the introduction of more diesel locomotives. All lines running north from Madrid are to be electrified (to Hendaye, Bilbao, Santander, Asturias, Monforte, Saragossa and, later, to Barcelona) and also the line south of Seville. Those lines already electrified will be interconnected for more economical working.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

32072. Ericsson Telephones, Ltd., and Acton, J. R.—Electronic counting and computing arrangements. 15th February, 1955. (805231.)

1954

3594. Birmetals, Ltd., and English Electric Co., Ltd.—Heat exchangers. 9th May, 1955. (805261.)

10005. Electric & Musical Industries, Ltd.—Phase control of television and other broadcast transmitter installations. 4th April, 1955. (805416.)

15727. Hotpoint Electric Appliance Co., Ltd.—Temperature control devices for electrically-heated washing machines. 6th May, 1955. (805440.)

17269. British Thomson-Houston Co., Ltd.—Electrical control means for winders, hoists, and the like. 31st May, 1955. (805351.)

32847. British Thomson-Houston Co., Ltd.—Rectifiers utilising semi-conducting material. 2nd November, 1955. (805443.)

33516. Electric & Musical Industries, Ltd.—Switches and circuits for generating saw-tooth currents. 4th November, 1955. (805464.)

34344. Philco Corporation.—Methods of electrolytically etching or plating bodies of semiconductive material. 26th November, 1954. (805291.) 34345. Semiconductor devices. 26th November, 1954. (805292.)

35643. Berghaus, B.—Carrying out of processes using electrical glow discharges. 9th December, 1954. (805163.)

1955

4967/8. Communications Patents, Ltd.—Radar simulation apparatus. 10th February, 1956. (805293/4.)

8590. Kollsman Instrument Corporation.—Inductive transducers. 24th March, 1955. (805466.)

17084. Preformed Line Products Co.—Holding or suspending appliance for linear bodies such as wire cables, electrical conductors or the like. 14th June, 1955. (805333.)

18564. Baldwin, H. T.—Magnetic ring transformers of the core balance type. 27th June, 1956. (805265.)

18701. General Electric Co.—Piezo-electric transducers. 28th June, 1955. (805470.)

20448. British Thomson-Houston Co., Ltd.—Electric motors. 12th July, 1956. (805223.)

25785. Carr Fastener Co., Ltd.—Holders for thermionic valves, electrical plugs or other electrical devices having projecting terminal prongs. 24th August, 1956. (805445.) 34210. Electrical connecting members having bayonet-type fastening means. 23rd November, 1956. (805446.)

25849. Standard Telephones & Cables, Ltd.—Voltage indicator discharge tube. 9th September, 1955. (805395.)

26321. General Electric Co., Ltd.—Rectifier assemblies. 11th September, 1956. (805284.)

27039. Automatic Telephone & Electric Co., Ltd., and British Telecommunications Research, Ltd.—Telephone systems. 6th September, 1956. (805396.)

27893/4. Standard Telephones & Cables, Ltd.—Electric capacitors. 30th September, 1955. (805132 and 805321.)

31351/2. Erie Resistor, Ltd.—Electrical capacitors. 31st May, 1956. (805233/4.)

33739. Siemens Edison Swan, Ltd.—Automatic telephone exchange systems. 20th November, 1956. (805326.)

36410. Smith, Ltd., H.—Electric conduits. 18th December, 1956. (805196.)

36648. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Receiver relays for electric remote control installations. 21st December, 1955. (805355.)

1956

1977. English Electric Co., Ltd.—Commutators for dynamo-electric machines. 18th January, 1957. (805227.)

2325 and 2399. Siemens Edison Swan, Ltd.—Automatic telephone systems and the like. 24th January, 1957. (805327/8.)

2608. Marconi's Wireless Telegraph Co., Ltd.—Temperature sensitive reactance devices. 7th September, 1956. (805135.)

2943. Mechanical Products, Inc.—Electric circuit-breakers. 30th January, 1956. (805447.)

3665. General Electric Co., Ltd.—Units for electric trunking systems. 5th February, 1957. (805200.)

5227. Busch-Jaeger Dürener Metallwerke A.G.—Electric time switching device. 20th February, 1956. (Addition to 791636.) (805307.)

5811. Philips Electrical Industries, Ltd.—Transistor pulse generators. 24th February, 1956. (805137.)

7268. Belling & Lee, Ltd.—Pin and socket type electrical connectors. 8th February, 1957. (Addition to 649739.) (805422.)

8691. Brush Electrical Engineering Co., Ltd.—Operating handle interlock for electric oil switch. 19th March, 1957. (805310.)

9935. Mullard Radio Valve Co., Ltd.—Electron-discharge tubes. 5th March, 1957. (805399.)

10664. Ega Electric, Ltd.—Electrical multi-contact devices. 21st January, 1957. (Cognate application 31828, 19th October, 1956.) (805171.)

14820. Commissariat a l'Energie Atomique.—Electronic apparatus. 11th May, 1956. (805175.)

16678. Westinghouse Electric International Co.—Electrical contact brushes. 30th May, 1956. (805176.)

17035. Siemens & Halske A.G.—Indirectly-heated cathodes for electric-discharge valves, and processes and apparatus for the manufacture thereof. 1st June, 1956. (805145.)

17670. A.C.E. Machinery, Ltd.—Electric passenger lifts. 22nd May, 1957. (805274.)

17784. Western Electric Co., Inc.—Electric circuit devices utilising semiconductor bodies and circuits including such devices. 8th June, 1956. (805207.)

18123. Siemens Edison Swan, Ltd.—Cold-cathode discharge tubes. 6th June, 1957. (805146.)

18789. Morle, C. W. (Oak Mfg. Co.).—Electric switches. 18th June, 1956. (805276.)

21786. Carr Fastener Co., Ltd.—Electric lamp sockets. 13th July, 1956. (Addition to 768159.) (805340.)

25431. Pruneau, P. M.—Magnetic cores. 20th August, 1956. (805428.)

25536. General Electric Co.—Thermionic cathodes and nickel alloys therefor. 21st August, 1956. (805229.)

25643. General Electric Co., Ltd., Cornell, W., and Simmons, J.—Manufacture of printed electric circuits. 13th September, 1957. (805230.)

33065. Allmänna Svenska Elektriska A.B.—Magnetic cores. 30th October, 1956. (805455.)

33571. Siemens-Schuckertwerke A.G.—Methods for producing ultra-pure substances, for example semi-conductor substances. 2nd November, 1956. (805246.)

38279. Maschinenfabrik Oerlikon.—Electric oil circuit-breakers. 14th December, 1956. (805278.)

38415. Globe-Union, Inc.—Electrical resistors. 17th December, 1956. (805345.)

39619. Bryant Electric Co.—Thermally-actuated electric switches. 31st December, 1956. (805410.)

1957

207. British Thomson-Houston Co., Ltd.—Earth fault protection for electrical equipment. 2nd January, 1957. (805456.)

1521. Tabet Manufacturing Co., Inc.—Rotary electric switches. 15th January, 1957. (805412.)

3343. Telefonaktiebolaget L. M. Ericsson.—Digitally operable electric selecting switches. 30th January, 1957. (805250.)

3536. Sperry Gyroscope Co., Ltd.—Plug-riveted tubular electric socket. 1st February, 1957. (805185.)

7101. Etna Machine Co.—Rotary electric resistance welders. 4th March, 1957. (805186.)

11186. Kolster-Brandes, Ltd.—Electric frequency changing circuits. 5th April, 1957. (805189.)

22006. Telefunken G.m.b.H.—Circuit arrangements embodying transistors. 11th July, 1957. (805359.)

28545/6. Berghaus, B.—Starting and carrying out of processes using electrical-glow discharges. 9th December, 1954. (Divided out of 805163.) (805164/5.)

1958

27241. Ericsson Telephones, Ltd., and Acton, J. R.—Voltage stabilising arrangements in electronic counting and computing apparatus. 15th February, 1955. (Divided out of 805231.) (805232.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 12th December :—

BELLING-LEE and BELLING & LEE, LTD. (designs). Nos. 772,746 and 772,752, respectively. Class 6. Metal fittings for aerials and electrical transmission lines. Nos. 772,747 and 772,753. Class 8. Thermionic valve extractors and valve pin straighteners. Nos. 772,748 and 772,754. Class 11. Portable electric lamps. Nos. 772,750 and 772,756. Class 17. Electrical insulators. Nos. 772,751 and 772,757. Class 19. Screened rooms and compartments impervious to radiations of radio frequencies. BELLING-LEE (design). No. 762,243. Class 9. Aerials, radio and television amplifiers, interference suppression devices, holders for fuses, holders for valves, printed circuits, lightning arrestors, transmission lines for aerials; and signal attenuators, terminals, plugs, sockets, connectors, fuses, switches, cut-outs, filters and signal transformers.—Belling & Lee, Ltd., Great Cambridge Road, Enfield, Mdx.

Design including cannon and "Do it Electrically." No. 748,289. Class 9. Electrical connections.—Cannon Electric (Great Britain), Ltd., 138, Wardour Street, London, W.1.

KING-CUB. No. 768,641. PRINCE-CUB. No. 768,642. Class 9. Radio receiving apparatus. — Teledictor, Ltd., Grovelands Road, Tipton, Staffs.

MICROTRON. No. 774,009. Class 9. Thermionic valves.—Plessey Co., Ltd., 1 Broad Street Place, London, W.C.2.

Design. No. 775,095. Class 9. Vacuum cleaners, electric kitchen utensils, bells, flat-irons and switches.—Compagnie Financière Immobilière & Mobilière, Cofimo, Gennevilliers, France. Address for service, c/o Trade Mark Protection Society, 50, Lincoln's Inn Fields, London, W.C.2.

BALARC. No. 777,851. Class 9. Electric arc welding apparatus.—Ashton Young Engineering Development Co., Ltd., 76, Cambridge Road, Kingston-upon-Thames.

INTERMEZZO. No. 780,192. Class 9. Radiogramophones and radio receivers.—Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

Wavey WASHERS

Beryllium Copper "Wavey" Washers. For Electronic Components. Range 10BA to ¼" B.S.F. Corrosion resisting, non-damaging to components, higher resistance of "set", higher recovery of load, permanent spring action. They are fabricated from Beryllium copper, heat treated to VPN.350 minimum, Electro Plated to DTD.924, Cadmium Plated to DTD.904 and Passivated to DTD.923. Samples and price lists on request.

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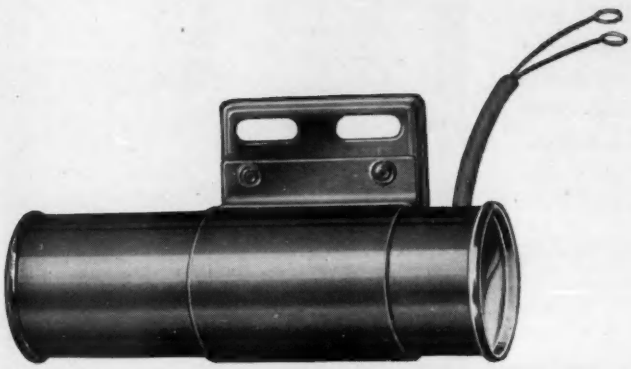

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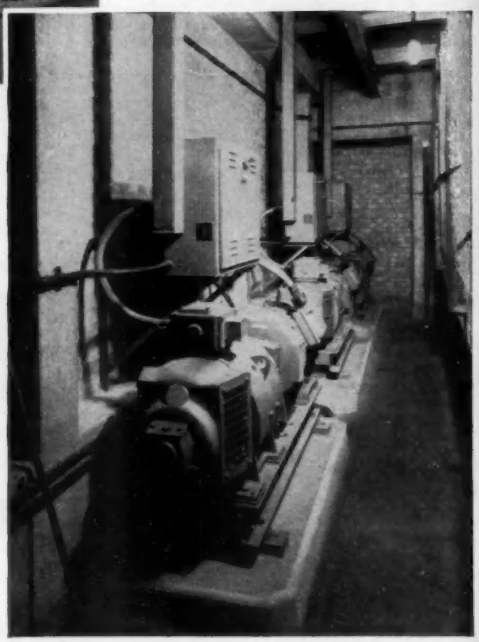

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 8th December

BIRMINGHAM.—Grand Hotel, Birmingham Electric Club. "Atomic Energy and Radio-isotopes," by W. C. Busbridge.

BRISTOL.—Bristol Engineering Laboratories, University Walk, 6 p.m. I.E.E. Western Centre and Groups. "Operational Experience at Calder Hall," by K. L. Stretch.

LEEDS.—British Lighting Council, 24, Aire Street, 6.15 p.m. I.E.S. Leeds Centre. "Lighting Calculations for Linear Fittings from Polar Curves," by R. R. Holmes.

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Investigations of Power-Follow Current Phenomena using a Synthetic Power Source," by Dr. L. L. Alston and Professor F. M. Bruce, and "The Impulse Initiation of Arc Discharges," by Dr. L. L. Alston.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "What Price for Amenities?" opened by J. E. Shepherd.

I.E.E. London Graduate and Student Section. Visit to Science Museum, South Kensington, S.W.7.

A.S.E.E. Central London Branch, 7.15 p.m. Visit to Falk, Stadelmann, Ltd., Mount Street, W.1. "My Experiences in America," by R. S. Falk.

MALVERN.—Winter Gardens, 7.30 p.m. I.E.E. South Midland Centre. "Zeta," by R. Carruthers.

NEWCASTLE-UPON-TYNE. — Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Centre. "Electrification of the U.K.A.E.A. Industrial Group Factories," by J. W. Binns and W. J. Outram.

NORWICH.—Assembly House, 7.30 p.m. I.E.E. East Anglian Sub-Centre. "Results of Full-Scale Stability Tests on the British 132 kV Grid System," by Dr. Ing. F. Busemann and W. Casson.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.S. Sheffield Centre. "Display Lighting," by J. Stewart.

STAFFORD. — County Technical College, 7.15 p.m. I.E.E. North Staffordshire Graduate and Student Section. Short papers evening.

WEMBLEY PARK.—Century Hotel, Forty Avenue, 8.15 p.m. A.S.E.E. North West London Branch. "Cold Cathode Lighting," by E. A. Langsdon.

Tuesday, 9th December

BEDFORD.—At W. H. Allen, Sons & Co., Ltd., 7.30 p.m. Institution of Production Engineers, Luton Branch. "Nuclear Power and Its Effects on the Production Engineer," by I. Munro.

BELFAST.—Queen's University, 6.30 p.m. I.E.E. Northern Ireland Centre. "Earthing of Low- and Medium-Voltage Distribution Systems and Equipment," by F. Mather.

CAMBRIDGE.—Cavendish Laboratory, Free School Lane, 8 p.m. I.E.E. Cambridge Radio and Telecommunication Group. "B.B.C. Sound Broadcasting on V.H.F.", by E. W. Hayes and H. Page.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South East Scotland Centre. "Design and Application of Large Solid-Rotor Asynchronous Generators," by P. Richardson.

39, Elmbank Crescent, 8 p.m. A.S.E.E. Glasgow Branch. "Ships' Electrical Systems."

LEEDS. — C.E.G.B., 1, Whitehall Road, 7 p.m. I.E.E. North Midland Graduate and Student Section. "Computation of Train Performance," by B. A. Tomlinson.

LONDON.—Savoy Place, W.C.2, 6.30 p.m. I.E.E. London Graduate and Student Section. "The Application of Electronics to Jet Engine Control," by H. E. Coles.

Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club. Luncheon. Guest speaker, J. E. S. Simon, Q.C.

Federation of British Industries, 21, Tothill Street, S.W.1, 6 p.m. Illuminating Engineering Society. Discussion on Technical Committee's Interim Report on Lighting Design Data.

PORTSMOUTH. — Ministry of Labour and National Service, Lake Road, 7.30 p.m. A.S.E.E. Portsmouth and District Branch. "Earthing and Earth Leakage Protection," by J. A. Robbins.

ROTHERHAM. — Y.E.B. Service Centre, 7 p.m. E.P.E.A. Sheffield Technical Group. "Operational Research," by F. N. Harper.

YORK.—Georgian House, Blossom Street, 7.30 p.m. A.S.E.E. York Branch. "Low Voltage Portable Tools."

Wednesday, 10th December

BIRMINGHAM.—James Watt Memorial Institute, 6.30 p.m. I.E.E. South Midland Graduate and Student Section. Senior Chairman's address, by J. Ashmore.

BLACKBURN. — North Western Electricity Board, Jubilee Street, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. "The Generation of Electricity in the London Area," by H. V. Pugh.

BRADFORD. — Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. "Magnetic Amplifier Control," by G. Horrobin.

ELTHAM.—Eltham Green School, Queenscroft Road, 7.45 p.m. A.S.E.E. South East London Branch. "Radar Aids to Navigation," by A. Vaux.

FARNBOROUGH.—R.A.E. Technical College, 6.30 p.m. I.E.E. Southern Centre. "Transistors in Communication and Control Equipment," by E. Wolfendale.

GLASGOW. — Central Hotel, Combustion Engineering Association, 10.30 a.m. "Carrying out a Heat Balance in a Plant," by H. H. Grattidge; 2.30 p.m. "Planned Maintenance," by T. W. Fishlock.

39, Elmbank Crescent, 6.30 p.m. Institution of Engineers and Shipbuilders in Scotland. Joint meeting with the Institute of Marine Engineers, Scottish Section. "Some Considerations Influencing Ship Nuclear Installations," by R. Y. Bell.

LEEDS.—St. Mark's House, Woodhouse Lane. Plastics Institute, Yorkshire Section. "The Fabrication of Thermoplastics," by T. S. Kirkby.

LLANDAFF.—Llandaff Technical College, 6.30 p.m. British Institution of Radio Engineers, South Wales Section. Annual general meeting followed by a discussion on "The Training of Electronics and Radio Engineers."

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio and Telecommunication Section. "Bridging the Atlantic," by A. H. Mumford.

Manson House, Portland Place, W.1, 6 p.m. Society of Instrument Technology, London Section. "An Experimental Approach to some Control Problems of Multi-Stand Rolling Mills," by H. Gill.

LUTON.—Chamber of Commerce, George Street West, 8 p.m. A.S.E.E. Luton Branch. "Rectifiers."

MANCHESTER. — Engineers' Club, Albert Square, 6.45 p.m. I.E.E. North-Western Radio and Telecommunication Group. "Electronic Devices in Guided Missile Systems," by Dr. G. H. Hough.

NEWCASTLE-UPON-TYNE. — Neville Hall, Westgate Road, 6 p.m. British Institution of Radio Engineers, North Eastern Section. "High Resolution Airfield Control and Ground Surveillance Radar," by P. H. Walker.

NORTHAMPTON.—College of Technology, 7.15 p.m. Northampton and District Electrical Association. "Electricity in Horticulture," by A. W. Gray.

RUGBY.—Rugby College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Recent Uses of Ultrasonics in Investigating the Characteristics of Materials," by Dr. J. Lamb.

Thursday, 11th December

ARBORFIELD. — R.E.M.E. Assembly Hall, 7 p.m. I.E.E. London Graduate and Student Section. District meeting. Repetition of chairman's address, by J. F. Outram.

CROYDON.—Greyhound Hotel, High Street, 8 p.m. A.S.E.E. South London Branch. "Transformers," by G. O. Castell.

DUBLIN.—Trinity College, 6 p.m. I.E.E. Irish Branch. "Earthing of Low- and Medium-Voltage Distribution Systems and Equipment," by F. Mather.

DUNDEE.—Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. "The Electrical Installation at Calder Hall 'A' and 'B' Nuclear Power Stations," by N. J. Mackay and E. Hardwick.

LEEDS.—Leeds University, 6.30 p.m. I.E.E. North Midland Centre. Joint meeting with I.Mech.E., Yorkshire Branch. "Modern Re-Heat Practice in Steam Power Stations," by F. H. S. Brown and J. W. H. Dore.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institutions of Electrical and Mechanical Engineers. Joint meeting. "The Deltic Locomotive," by C. M. Cock.

At the Royal Institution, Albemarle Street, W.1, 6.30 p.m. Institution of Production Engineers. The 1958 Sir Alfred Herbert Paper. "The European Common Market—Its Origins and Implications," by Sir Cecil Weir.

NORTHAMPTON. — I.E.E. Rugby Graduate and Student Section. "Testing of High Voltage Power Transformers," by R. E. James.

SWANSEA.—South Wales Electricity Board, The Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Operational Experience at Calder Hall," by K. L. Stretch.

TORQUAY.—S.W.E.B. Showrooms, Union Street, 3 p.m. I.E.E. South-Western Sub-Centre. "Diesel and Diesel-Electric Traction," by A. H. Bloomer.

Friday, 12th December

ABERDEEN.—Robert Gordon's Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Electrical Installation at Calder Hall Nuclear Power Station," by N. J. Mackay and E. Hardwick.

BIRMINGHAM. — Imperial Hotel, 1 p.m. E.I.B.A. Birmingham and District Branch. Annual general meeting and luncheon.

CREWE.—Royal Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. "Fuel Efficiency," by H. B. Weston.

LEICESTER. — Technical College, The Newarkes, 7.15 p.m. I.E.E. East Midland Centre. Joint meeting with the Leicester Association of Engineers. "The National-Elliott 405 Computer and its Application to Production Procedures," by H. A. Mathews.

LONDON.—Savoy Place, 6 p.m. I.E.E. Education Discussion Circle. "The Teaching of Mathematics to Engineers."

14, Rochester Row, Westminster, S.W.1, 7.30 p.m. Junior Institution of Engineers. Induction of W. M. Larke as president and presentation of awards.

Caxton Hall, Westminster, S.W.1, 6.30 p.m. E.P.E.A. Meter Engineers' Technical Group. "Recent Development in the Repairs and Testing at a Large Meter Station," by H. J. Mockett.

21, Albemarle Street, W.1, 9 p.m. Royal Institution of Great Britain. "The Fusion of Heavy Hydrogen," by Dr. T. E. Allibone.

MANCHESTER. — Engineers' Club, Albert Square, 6.30 p.m. Institution of Heating and Ventilating Engineers, Manchester and District Branch. "Practical Experiences of Off-Peak Heating by Electricity," by L. W. Bower.

NEWPORT (I. OF W.).—Southern Electricity Board, 6.30 p.m. I.E.E. Southern Centre. Open discussion.

WEYMOUTH.—South Dorset Technical College, 6.30 p.m. I.E.E. Southern Centre. "The Design of Transistors," by J. R. Tillman. (Meeting brought forward from 28th November.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—State Electricity Commission, Brisbane. 25th February. Two 30,000 kW water driven turbo-alternators, inlet valves and accessories. (E.S.B. 28547/58. Ten/35927.)*

State Electricity Commission of Victoria, Melbourne. 29th April. Supply and erection of boiler plant and buildings and coal handling plant for a 400 MW thermal power station at Hazelwood. (E.S.B. 28764/58. Ten/35926.)*

Burma.—Burma Purchase Board, Rangoon. 11th December. Cables. (E.S.B. 29027/58. Ten/35969.)*

Ceylon.—Department of Government Electrical Undertakings, Colombo. 24th December. Electric lamps. (E.S.B. 29151/58. Ten/35998.)* 31st December. Two 500 kVA transformers. (E.S.B. 28849/58. Ten/35938.)*

Cornwall.—County Council. Applications to tender for electrical services at new county secondary schools should be submitted by 13th December. (See this issue.)

Glanford Brigg.—R.D.C. 1st January. Supply and erection of duplicate sewage pumps, complete with motors, compressors, starters and accessories (Contract No. 4) and duplicate sewage ejectors, complete with motors, compressors, starters and accessories (Contract No. 5). John H. Haiste & Partners, consulting engineers, Belmont House, 20, Wood Lane, Headingley, Leeds, 6.

Honiton.—Corporation. 31st December. Lighting equipment, including chokes, capacitors, lamps, time switches and steel columns. (See this issue.)

Iran.—State Railways Administration, Teheran. 31st December. Overhead and underground cables. (E.S.B. 29087/58. Ten/36028.)*

Lytham St. Annes.—Corporation. 19th December. Supply, erection and wiring of 178 lighting columns, together with control gear, for group "A" and town centre installations. Borough engineer, Town Hall.

New Zealand.—G.P.O., Wellington. 12th January. Insulating paper and pressboard. (E.S.B. 29192/58. Ten/36008.)* 15th January. Capacitors. (E.S.B. 29193/58. Ten/36009.)*

Norwich.—Corporation. Pumping equipment for sewage purification works. (See this issue.)

Pakistan.—Directorate-General, Posts and Telegraphs, Karachi. 15th December. Relays. (E.S.B. 28788/58. Ten/35939.)*

Director-General of Supply, Chittagong. 12th January. Power press and electric furnace. (E.S.B. 28933/58. Ten/35965.)*

Director-General, Department of Supply and Development, Karachi. 29th December. One 5 kW and two 4 kW diesel-electric generating sets. (E.S.B. 28896/58. Ten/36015.)*

South Africa.—Stores Department, South African Railways, Johannesburg. 17th December. Lead acid storage batteries. (E.S.B. 28900/58. Ten/35944.)* 19th December. Batteries for electric locomotives. (E.S.B. 28839/58. Ten/35936.)*

Union Tender and Supplies Board, Pretoria. 8th January. Radio telephone terminal apparatus. (E.S.B. 28941/58. Ten/35945.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Southend-on-Sea. — Corporation. 29th December. Electrical installation at Westborough Junior School. (See this issue.)

Sutton Coldfield.—Corporation. 1st January. Trunk road lighting equipment. (See this issue.)

ORDERS PLACED

Ealing.—Housing Committee. Recommended. Rewiring and additions to electrical installations in 961 dwellings on the South Ealing estate (£23,562).—Electrical Contracting Co.

Lancashire.—Education Committee. Renewal of electrical installation at Heywood Bamford Road Boys' County Secondary School (£2,343).—T. Tomlinson.

London.—British Transport Commission. Accepted. Six level-luffing electrically-operated portal cranes for use at Bentinck Dock, King's Lynn.—Thomas Smith & Sons (Rodley), Ltd.

Newcastle-under-Lyme. — Corporation. Recommended. Installation of street lighting from Milehouse Lane to Crackley Bank (£12,995).—G.E.C.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Ayr.—Houses (204), Annpit Quarry site; burgh surveyor.

Barking.—Conversions at old town hall to form court house (£22,000); H. Conolly, Essex county architect, County Hall, Chelmsford.

Billingham-on-Tees.—R.C. church, Grosmont Drive (£40,000); F. Keelan, Ltd., builders, 1, King Street, Thornaby-on-Tees.

Special school; R. Cowan, architect, 123, Victoria Road, Darlington.

Birmingham.—Headquarters building at Edgbaston, for the Birmingham Chamber of Commerce; J. H. Madin, architect, 83, Hagley Road, Edgbaston, Birmingham.

Blackpool.—Special school; Grenfell Baines & Hargreaves, architects, 58, Topping Street.

Brentford and Chiswick.—22 shops with 70 flats over, in connection with redevelopment scheme, Ealing Road area; W. F. Church, town clerk, Town Hall, Chiswick, W.4.

Caernarvon.—Works and offices; Ashburton Chemicals, Ltd., Tenax Road, Old Trafford, Manchester.

Cirencester.—Factory and offices for British Tabulating Machine Co., Letchworth; John Pattison, Ltd., builders, Bramble Road, Swindon.

Croydon.—Flats and maisonnettes (44), Ely Road; Walker (Tooting), Ltd., builders, Hackbridge Road, Wallington.

Darlington.—New St. Mary's Grammar School; R. Blackett & Son, Ltd., builders, 63, Bondgate, Darlington.

Dorchester.—Kitchens and dining rooms for County Hospital (£30,000); Arthur Parsons & Sons, builders, Three Lanes.

Dudley.—Houses (126), Wren's Nest Road; borough architect.

Durham.—Junior school at Newton Aycliffe (£57,000); R. G. Finlay, Ltd., builders, Ryhope, Sunderland.

Epsom and Ewell.—Houses (60), Ruxley Farm estate, West Ewell; C. Cobbett, borough engineer, Town Hall, The Parade, Epsom.

Guildford.—Civic hall and offices; Bridgwater & Shepheard, architects, 42, Bruton Place, W.1.

Hereford.—Three-storey showrooms and offices, Broad Street; D. J. McLennan, architect, St. Owen Street.

Hounslow.—Works and offices, Green Lane; Perrett Controls, Ltd., 237, Acton Lane, W.4.

London.—Three blocks of flats, St. Martin's estate, Lambeth; Sir Lindsay Parkinson & Co., Ltd., builders, 6, Lambeth Road, S.E.1.

Manchester.—Dwellings (222), Partington; city architect.

Works, Trafford Park; Geo. T. Layton & Partners, engineers, 24, Clarendon Road, Eccles.

Middlesbrough.—Houses (40), Easterside estate; "Emco" Builders, Ltd., contractors, North Ormesby, Middlesbrough.

Newcastle-on-Tyne.—Radiotherapy department, General Hospital, for Newcastle Hospital Board (£14,500); Milton Swales, Ltd., contractors, Imeary Street, South Shields.

Nuneaton.—Houses (375), St. Nicholas Park estate; F. Pallett, Ltd., builders, Dugdale Street.

Peterborough.—Further instalment of Newark Hill Primary School; Warwick & Ellis, architects, 43a, Priestgate, Peterborough.

Prudhoe (Northumberland).—Laundry and engineering workshops at Prudhoe and Monkton Hospital, for Newcastle Hospital Board (£22,600); Shield Brothers, contractors, Swalwell.

Rotherham.—Civic theatre; Hadfield, Cawkwell & Davidson, 1, High Court, Sheffield.

Sheffield.—Twelve-storey teaching block and assembly hall for College of Technology; Gollins, Melvin, Ward & Partners, architects, 281, Glossop Road.

Slough.—Flats (78), Church Street, Chalvey, Lower Cippenham Lane and Everitts estate; borough engineer, Town Hall.

Southbourne (Sussex).—Extensions to secondary modern school comprising new teaching block and dining hall and extensions to kitchen, etc.; West Sussex county architect, County Hall, Chichester.

Stanley (Co. Durham).—Houses (77), Wesley Terrace; G. M. Pearson & Son, Ltd., contractors, Front Street, Hetton.

Stevenage.—Seven-storey building for headquarters, Town Square site; chief engineer to Development Corporation, Aston House, Stevenage, Herts.

Sunderland.—Houses (54), Bainbridge Holme estate; J. W. Ridley, Ltd., builders, Bridge Approach, Southwick, Sunderland.

Swadlincote.—New lending library; W. Blair, architect, Burton House, Burton Road, Derby.

Teignmouth.—Theatre and conference hall on site of old Carlton Cinema (£45,000); surveyor, Bitton Park.

Thornaby-on-Tees.—Offices, Chapel Street, for British Road Services; A. H. Roberts, architect, 150, Goswell Road, London, E.C.1.

Wakefield.—Houses and flats (150), Ivy House estate and Primrose Hill; W. S. des Forges, town clerk, Town Hall.

Walsall.—Fourth instalment of the Walsall and Staffs. Technical College, Wisemore; V. Millson, secretary to Governors, Education Offices, Darwall Street, Walsall.

Washington (Co. Durham).—Development of the Hostel estate (600 houses) for U.D.C.; T. E. Crowe, surveyor.

Flats (34); J. & T. Robson, Ltd., contractors, Springwell.

Weston-super-Mare.—First stage of Municipal College; R. O. Harris, architect, Park Street, Taunton.

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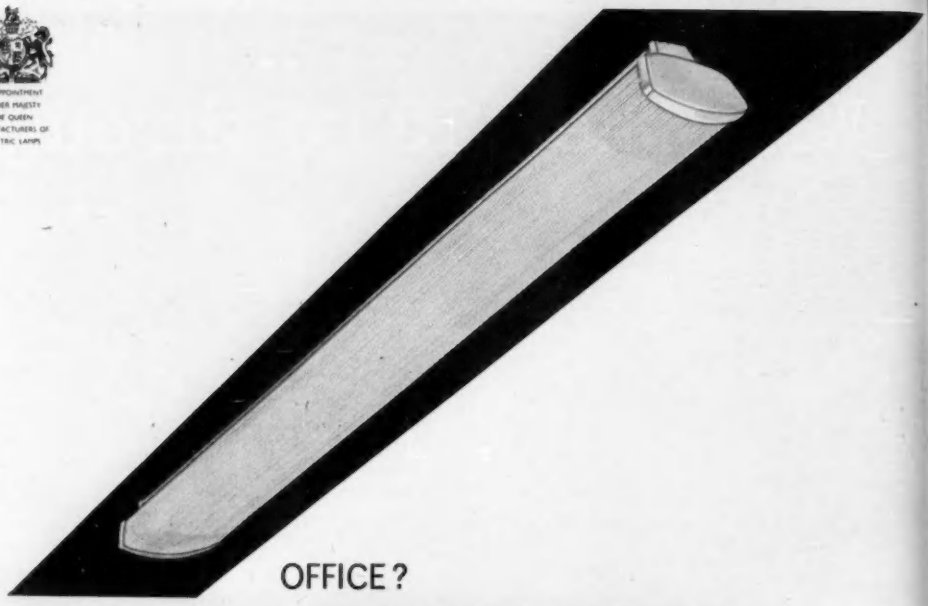

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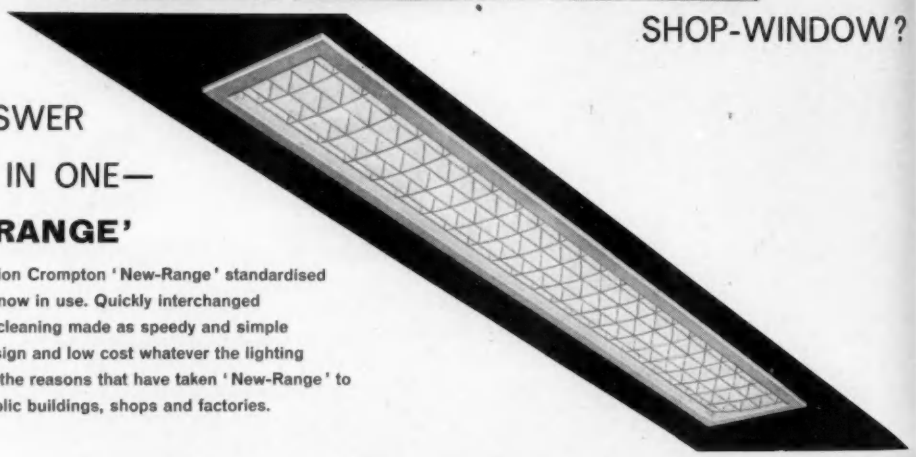

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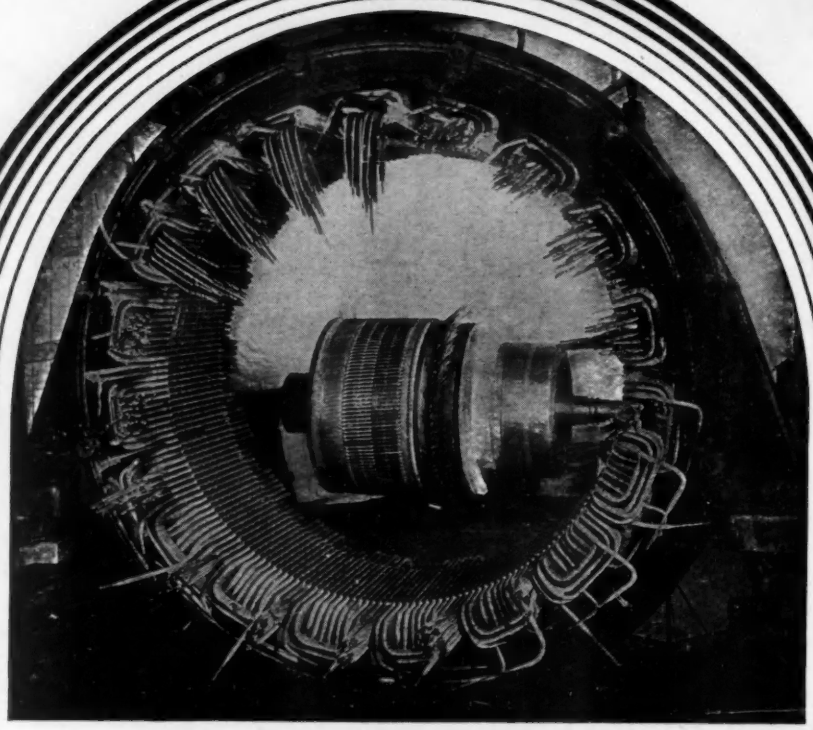

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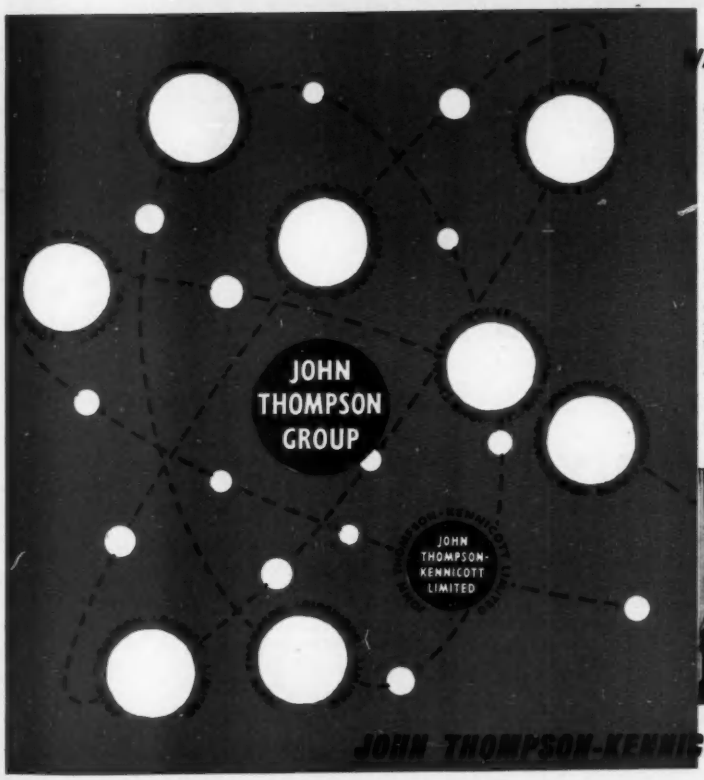

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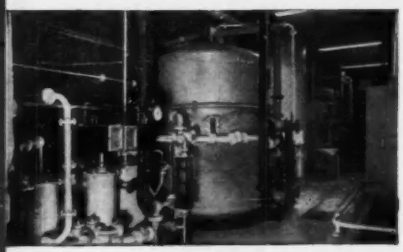

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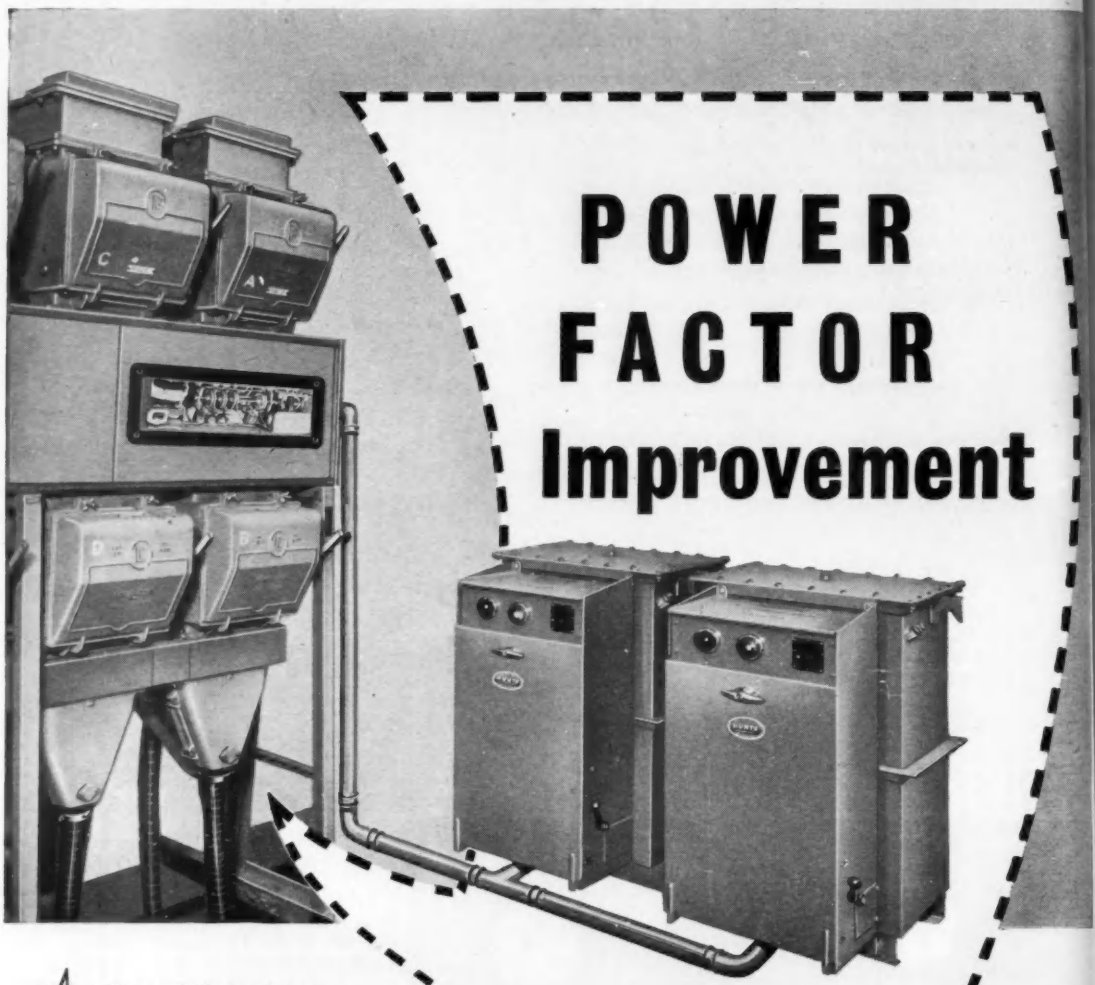

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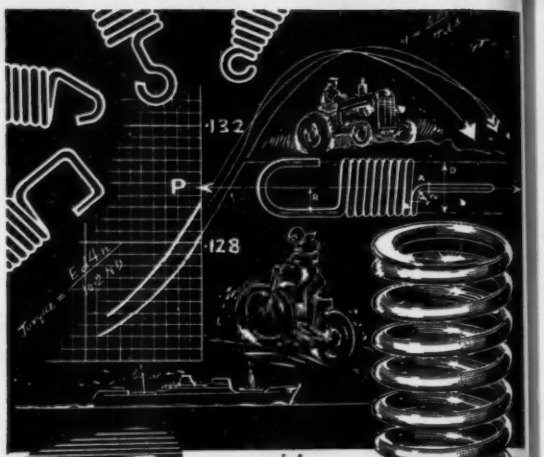

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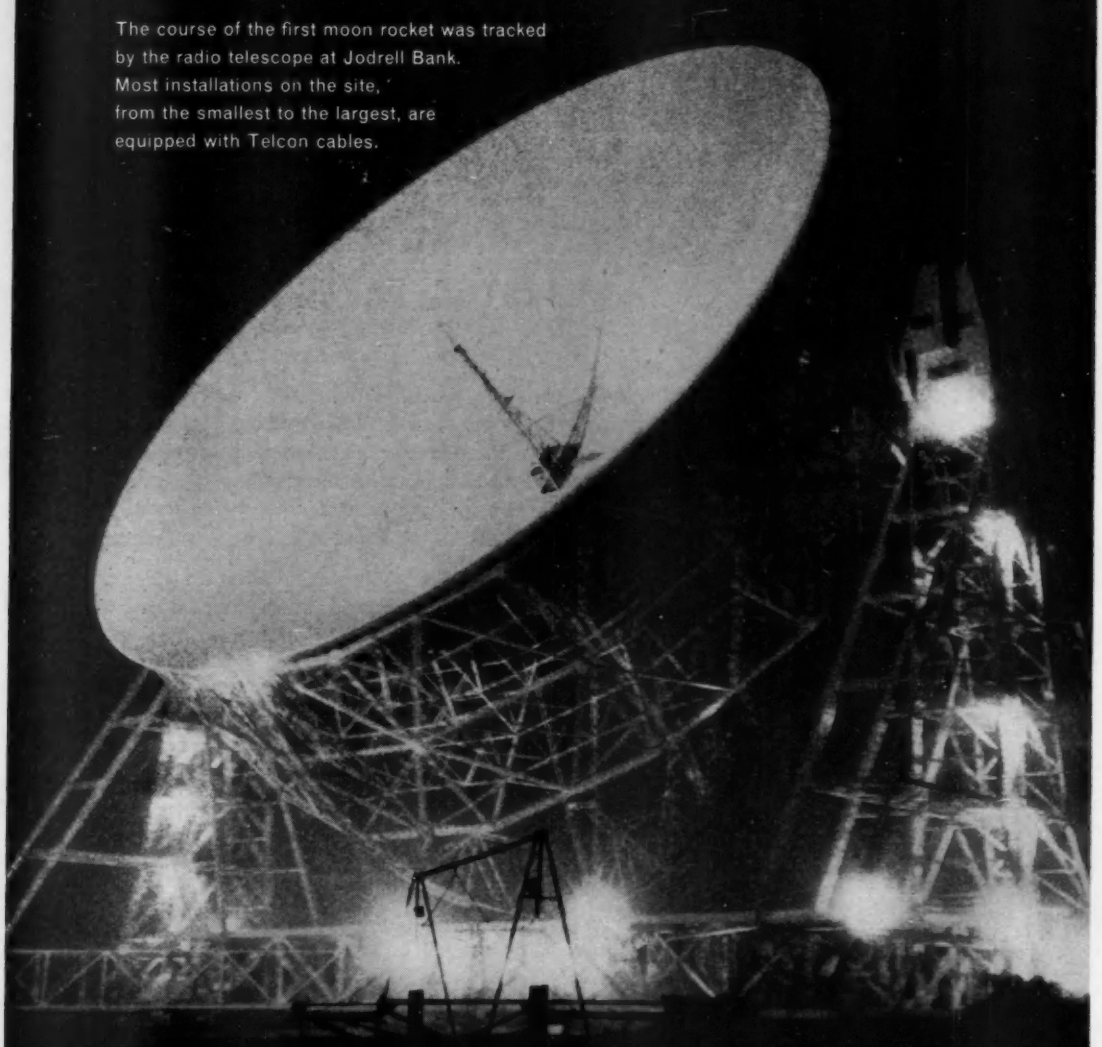

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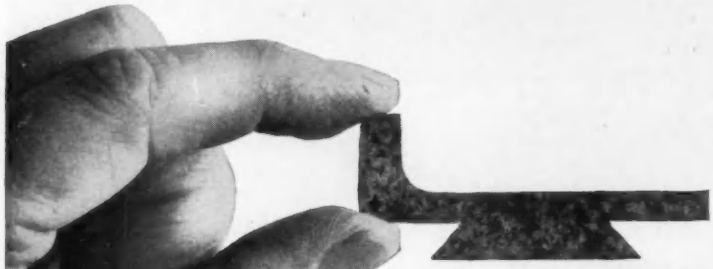

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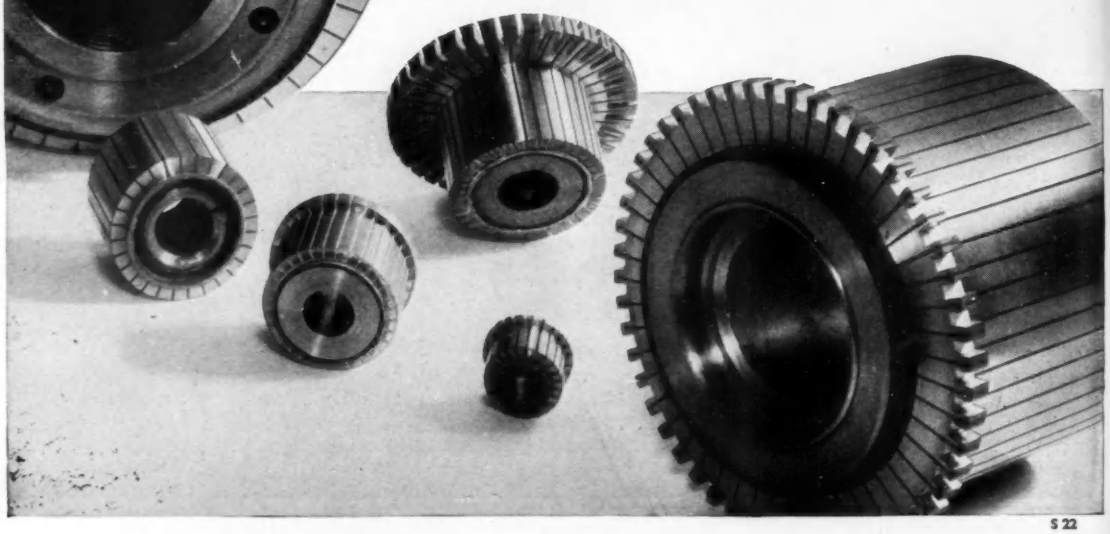

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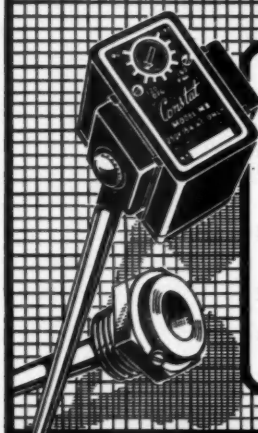

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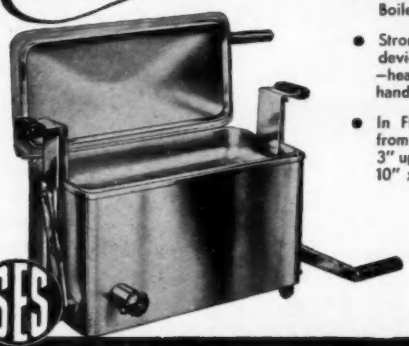

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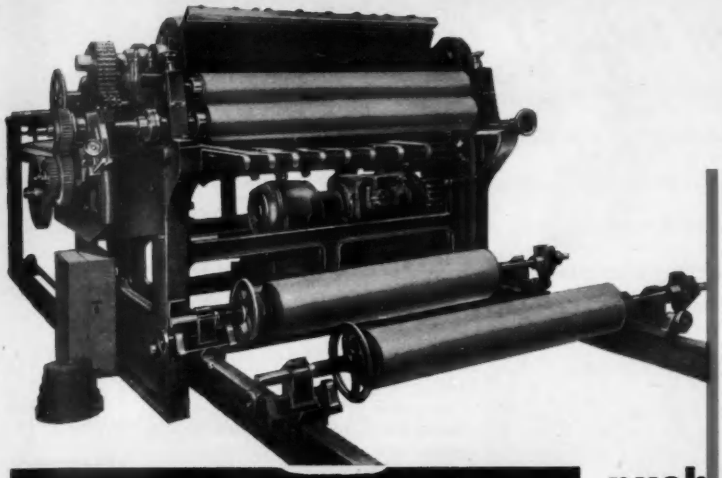

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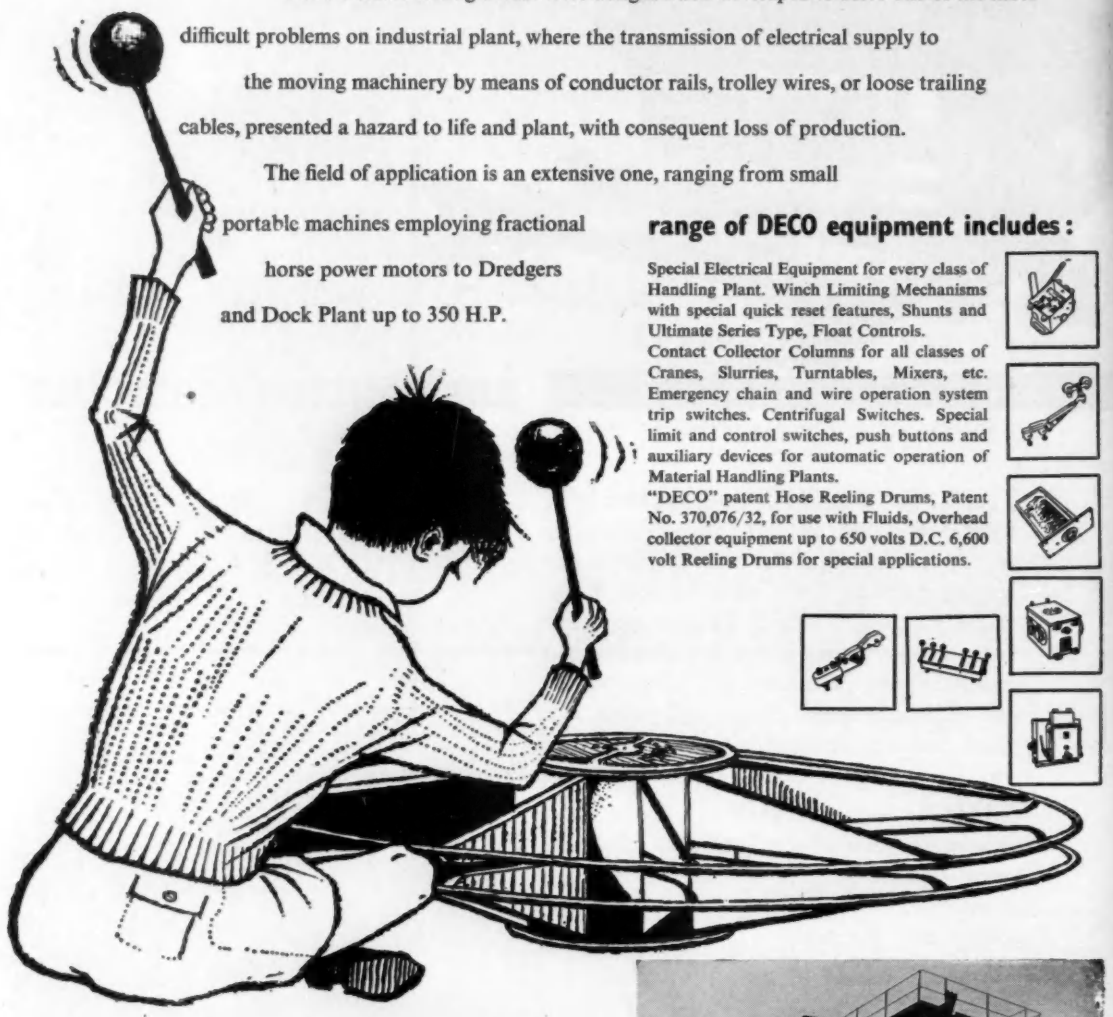

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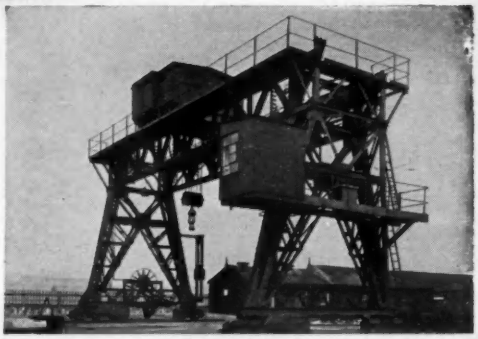

An illustration of a counter-weight operated radial reeling drum accommodating 130 feet of 4-core 1.3" overall diameter reinforced trailing cable for a 40-ton Goliath crane. (Photograph by kind permission of Messrs. Stothert & Pitt Ltd.)

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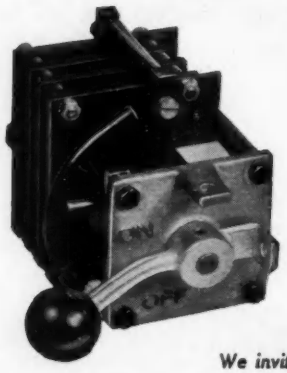

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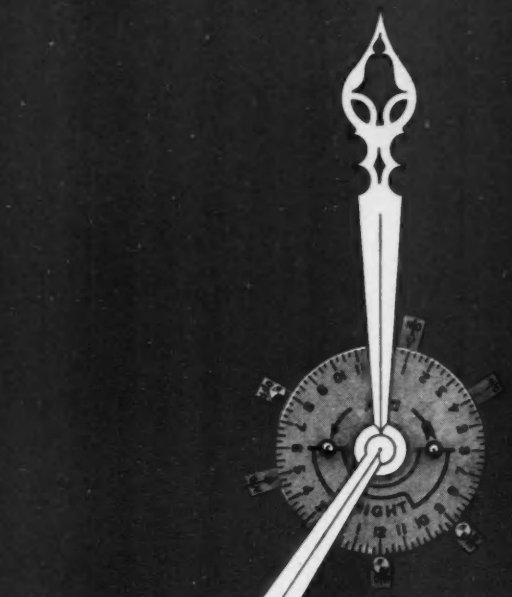

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500 volts:
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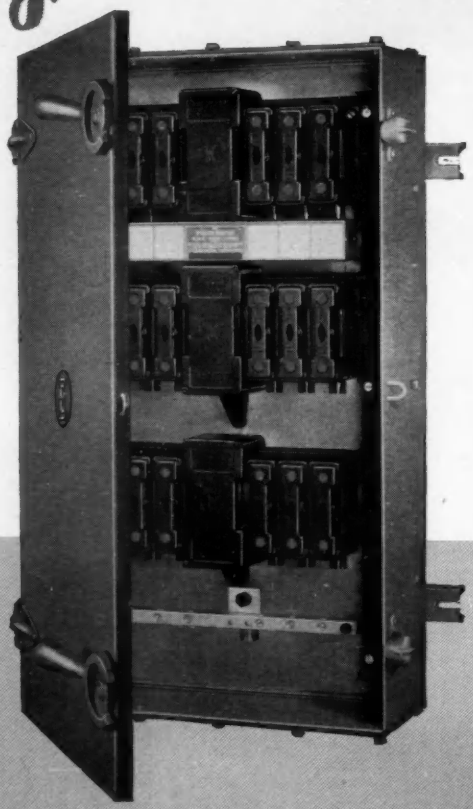

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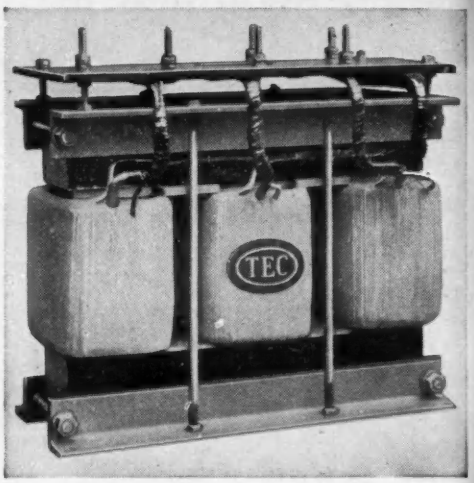

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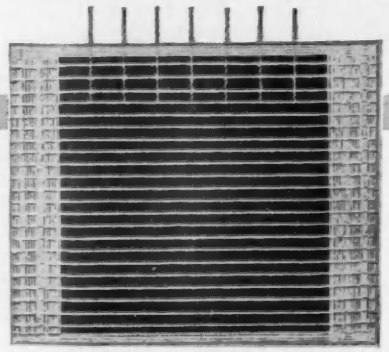
CRESSALL Asbestos Woven Resistance Nets are light, flat, vibration and shock proof and require only the simplest of supports for making up into banks.

We offer our customers a specialised service and are prepared to manufacture resistance nets of any reasonable size to meet their exact requirements.



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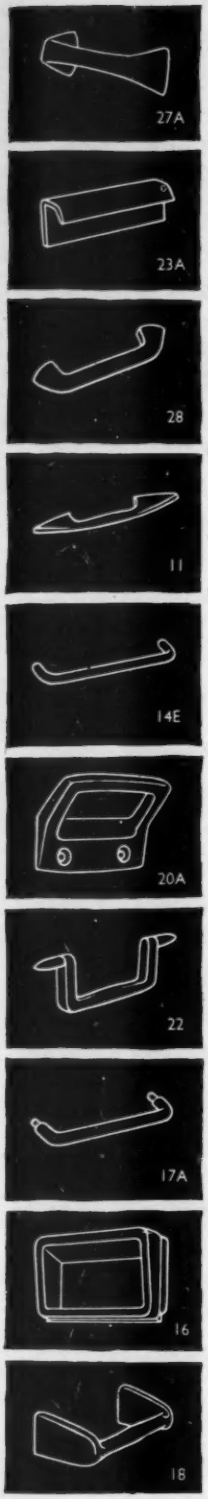

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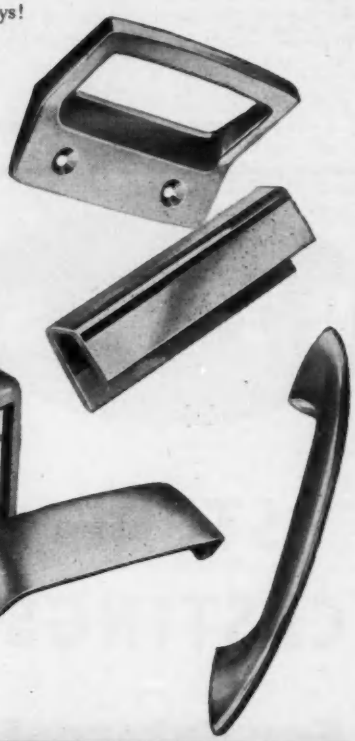

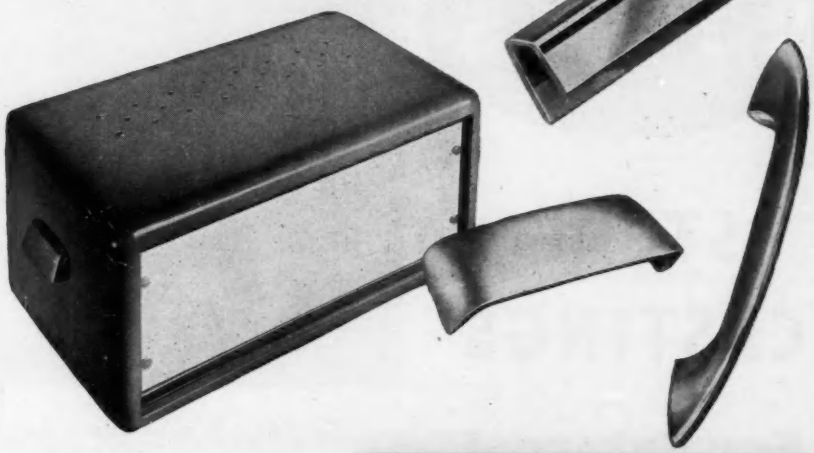

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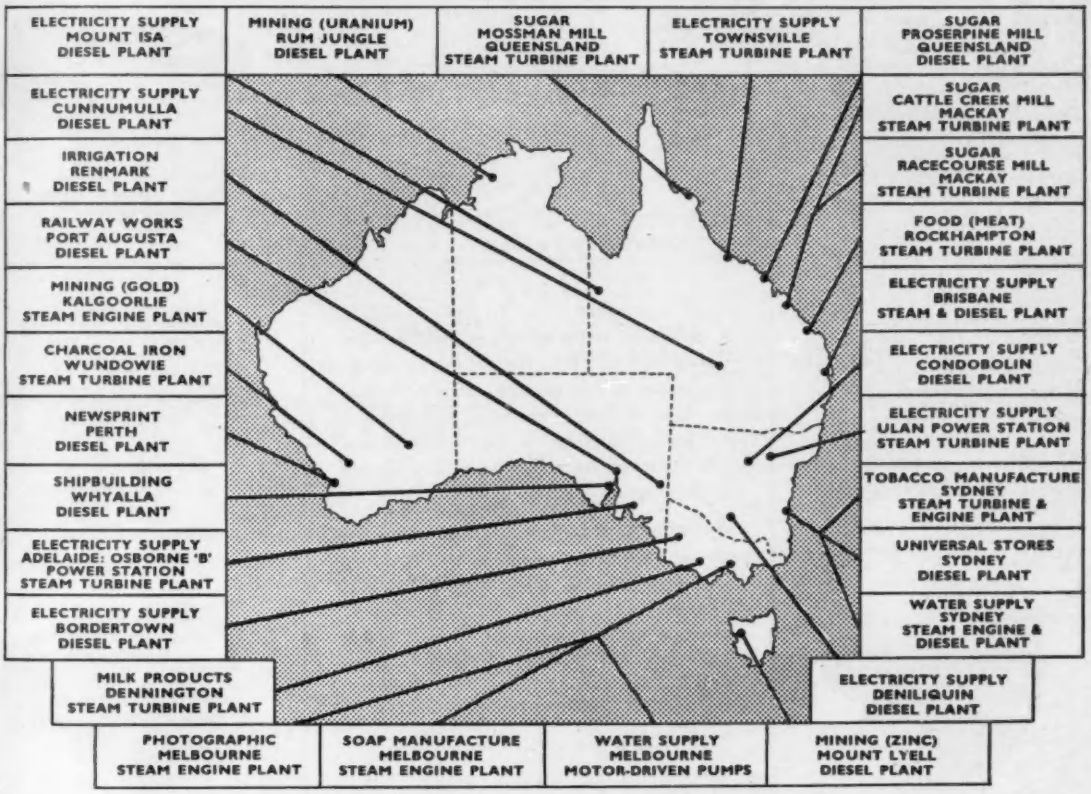
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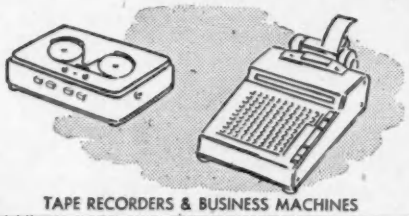

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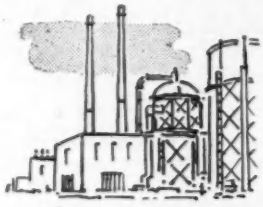

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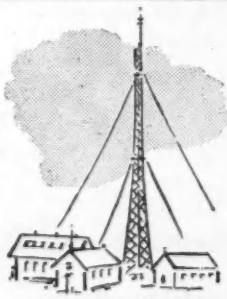

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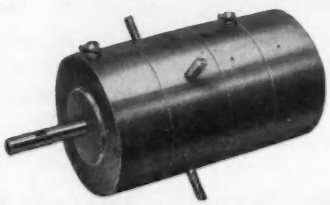

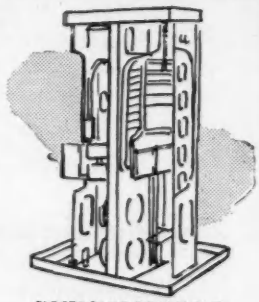

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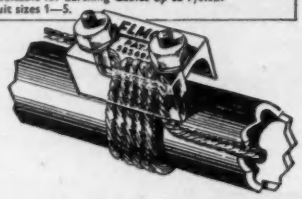
A COMPLETE RANGE TO B.S.951. 1948

IN 4 SIZES	A123	B45	C67	D8910
for earthing cables up to	7/0.036"	7/0.064"	19/0.064"	19/0.083"
to fit B.S. conduit sizes i.e. in trade terms	1, 2 & 3 ½" to ¾"	4 & 5 1" and 1¼"	6 & 7 1¼" and 2"	8, 9 & 10 2½" to 3½"

NOTE ALSO: Type A123 is suitable for Earthing Cables up to 7/0.029" and for B.S. conduit sizes 1—5.



"Elmo" Earthing Clamps are of robust construction. Impossible for wire to pull out, always under tension, therefore a most satisfactory earth and a permanent safeguard.

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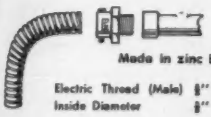
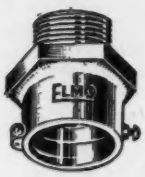


Flexible-to-rigid
CONDUIT COUPLINGS

Made in zinc base alloy in the following sizes

Electric Thread (Male)	⅜"	½"	1"	1¼"	1½"	2"
Inside Diameter	⅜"	½"	1"	1¼"	1½"	2"
Electric Thread (Male)		¾"	1"	1½"		
Inside Diameter Flexible Conduit	½"	⅝"	¾"	1"		



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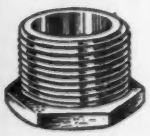
Special Features: Integral Earthing Terminal, tinned ready for soldering. Fixing screw for continuity. Internal threads suit all makes of flexible tubing.



MALE
Hex. Section

CONDUIT BUSHES

Made in the following sizes:

MALE: Electric Thread
⅜" ½" 1" 1¼" 1½" 2"

FEMALE: Electric Thread
⅜" ½" 1" 1¼" 1½" 2"

FEMALE
Flat Face Section for Spanner (except ⅜" size, which is round)

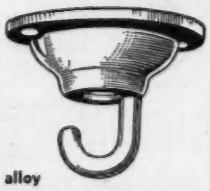
CONDUIT HOOK

For fluorescent lamps and overhead lighting fittings. Screwed ⅜" thread, male electric.

Made to fit all standard boxes with two holes 7/32" diameter — 2" centres diametrically opposed. Designed in accordance with British Standard Specification.

CEILING PLATE

One hook



Both made in aluminium alloy

Manufactured by M. MOLE & SON LTD.
BIRMINGHAM · 3 · ENGLAND Est. 1835

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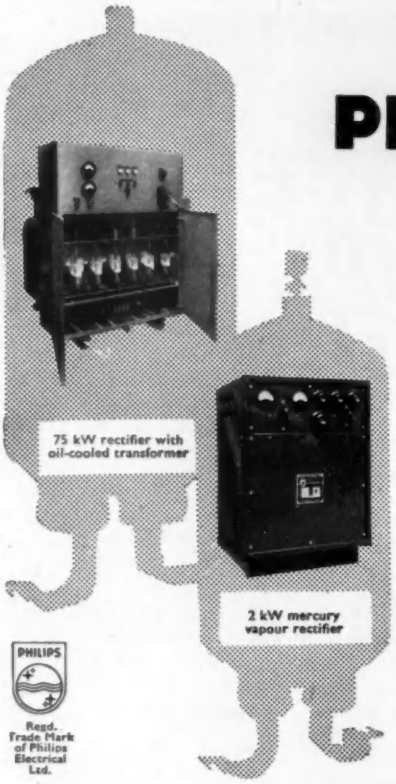

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for industrial and laboratory use

- 500 W—75 kW
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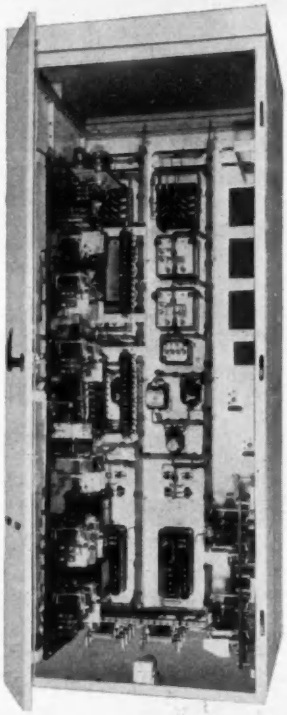

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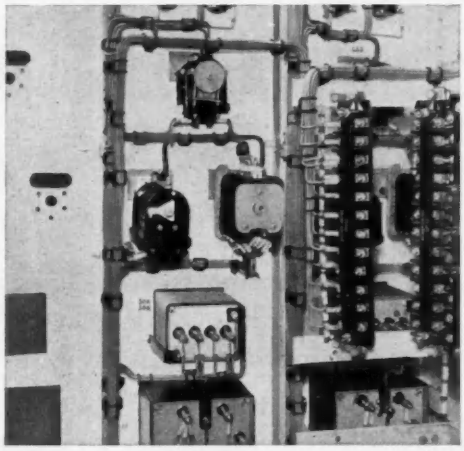

Close-up of Auto-reclose cubicle showing compact neatness of CRADLECLIP installation.

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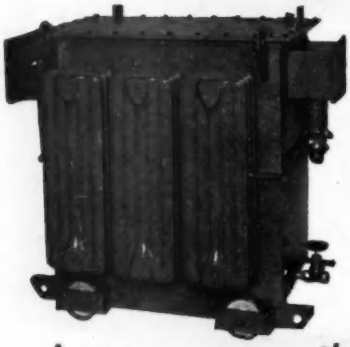

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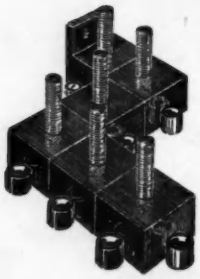

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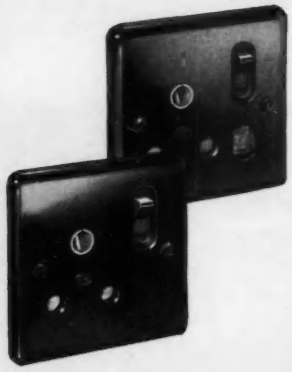

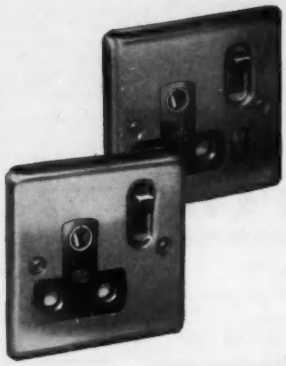

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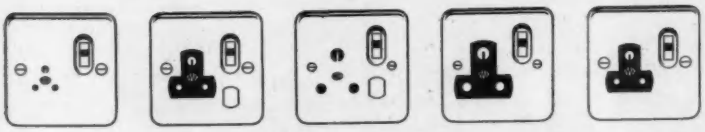

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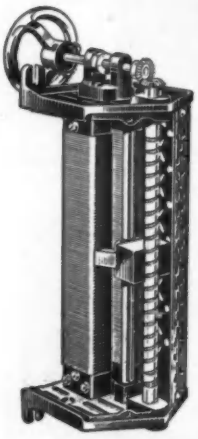

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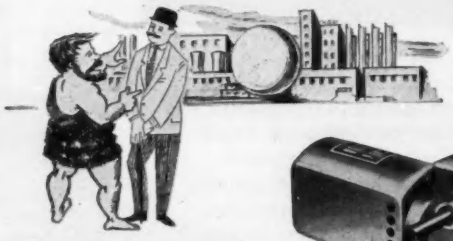
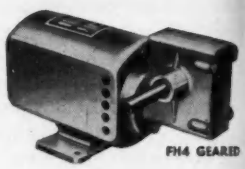


TALKING ABOUT TORQUE



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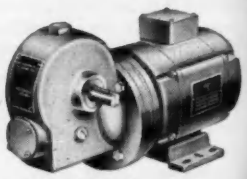

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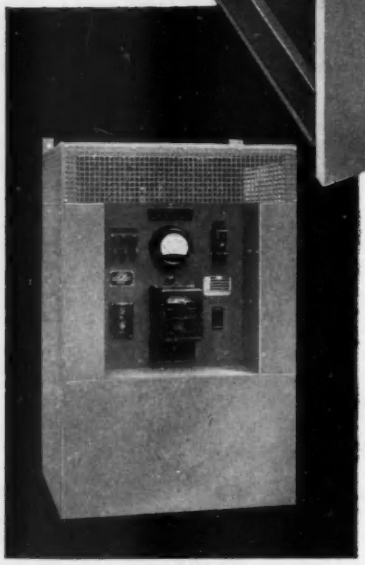

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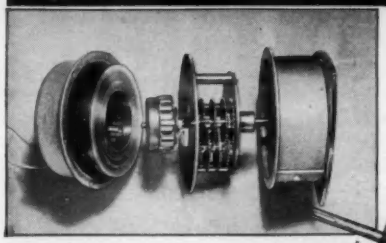
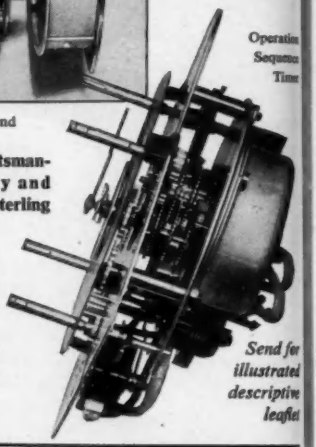


Operation
Sequence
Time



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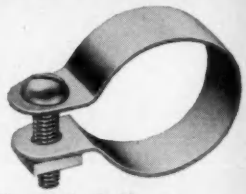

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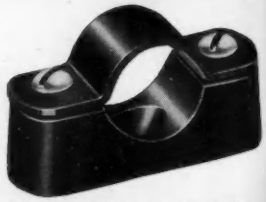

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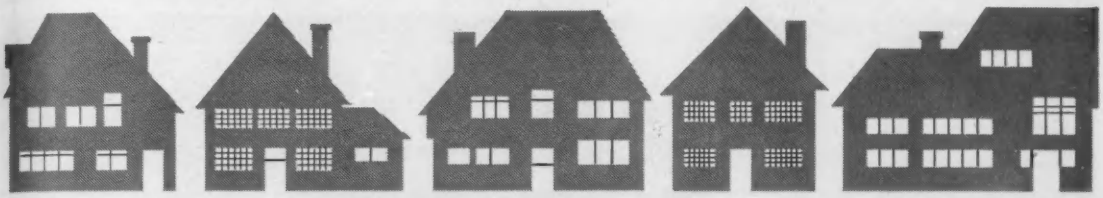

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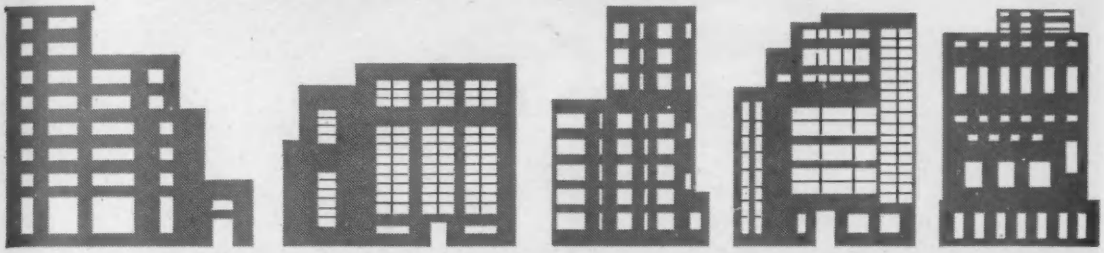

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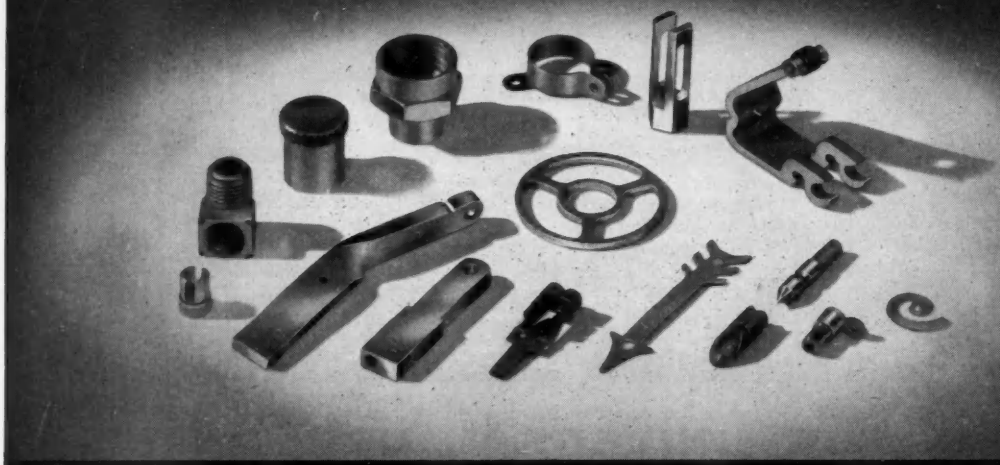

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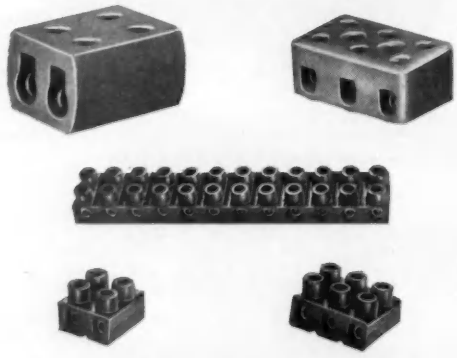

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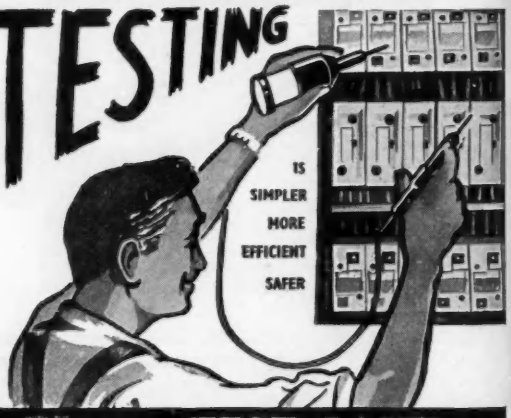

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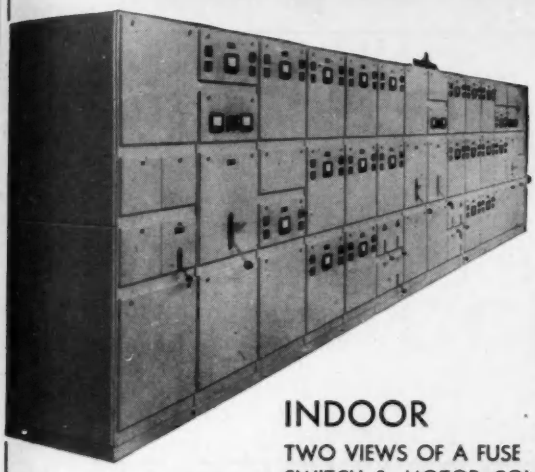

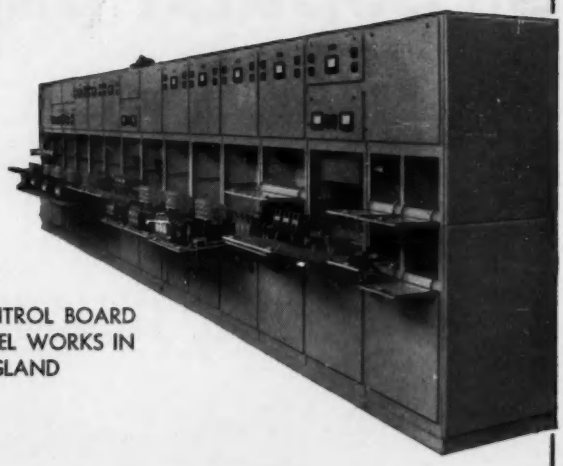

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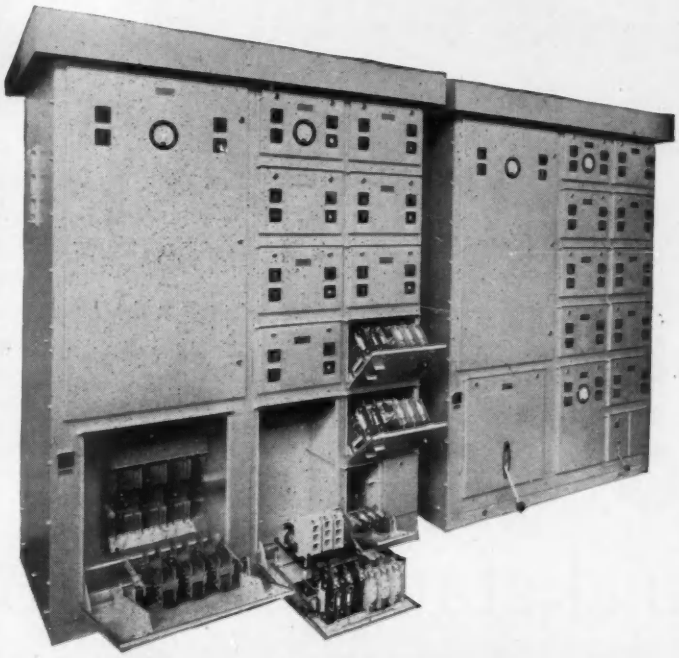

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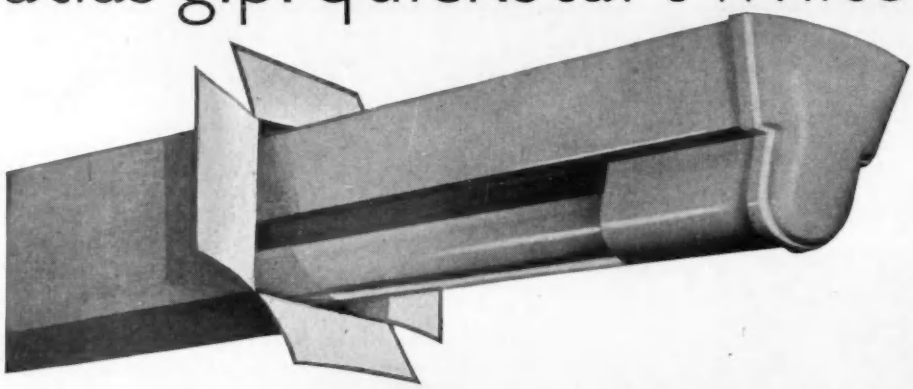

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* suitable for 230/240 volts only

ATLAS LIGHTING LIMITED A subsidiary company of Thorn Electrical Industries Limited 233 SHAFTESBURY AVENUE LONDON WC2

ANNOUNCING

the manufacture in England of the Complete Range of

Preformed

LINE ACCESSORIES

The **Preformed** technique combines maximum holding power with low localized pressure and eliminates fatigue arising from stress concentrations.

It is used to make a wide range of accessories including: Guy-grips and Dead Ends, Spacers, Armour Rods, Line Splices, Line Guards, Patch Rods, Splice Shunts, Armour Grip Suspension Units, Lashing Rods, Tangent Supports.

IN:

galvanised steel, aluminium alloy, cadmium copper, stainless steel.

FOR:

Overhead Transmission Lines, Railway Signals and Telegraphs, Telephone Engineering, and many other applications.

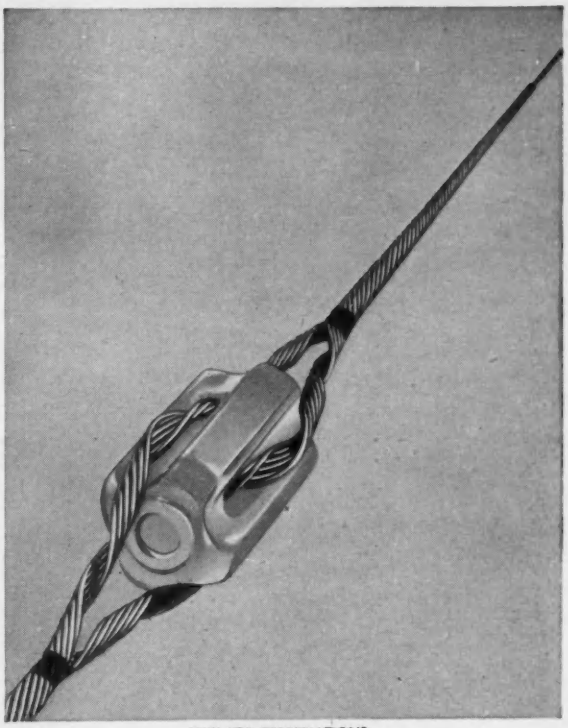
Their gripping power **exceeds the line breaking strength;**

They can be fitted **in minutes without tools;**

They enable linesmen **to do a better job quicker;**

They reduce labour and material costs.

Wherever stranded or single wires are to be gripped, the Preformed technique has outstanding advantages.



GRIP FOR TERMINATIONS

BRITISH PLP

USED THROUGHOUT THE WORLD

We shall be at the Electrical Engineers Exhibition at Earls Court, March 17th—21st, 1959.

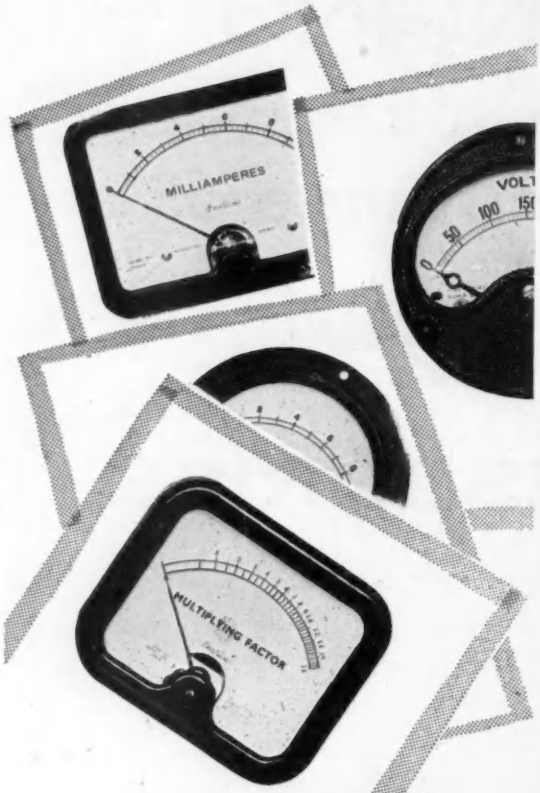
For further details write to:

PREFORMED LINE MATERIALS, LTD

ANDOVER · HAMPSHIRE · ENGLAND Telephone: ANDOVER 4045

MANUFACTURED UNDER LICENCE FROM PREFORMED LINE PRODUCTS CO. CLEVELAND, OHIO, U.S.A.

AP 11A



meters à la carte

You will find most normal Baldwin, E.A.C., Taylor, Turner, Weir, Weston and other meters in stock at Anders—ready to be served up at once. But Anders take a special pride in their *à la carte* service: non-standard meters of all kinds, shapes, sizes, voltage or current ranges, are supplied within 7-14 days, accurately calibrated, with dials specially drawn. Service is quick and efficient.

Anders electronics LTD

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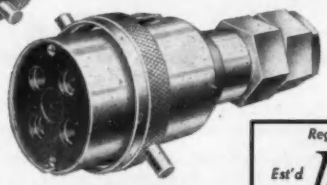
Contractors to G.P.O. and Government Departments

Meters, Electronic and Test equipment to individual specifications

McGEOCH

WATERTIGHT
SOCKETS
AND
PLUGS

Illustration shows special 300 amp. 500 volt application with Indicator lights incorporated—for use on Drilling Pontoon



Registered Est'd M G 1832 Trade Mark

also CONTROL CUBICLES
INDICATOR LIGHTS and UNITS

WILLIAM McGEOCH & CO. LTD. (Dept. R.E.)
BORDESLEY, BIRMINGHAM 10
also **GLASGOW, C.2** *and* **LONDON, W.1**

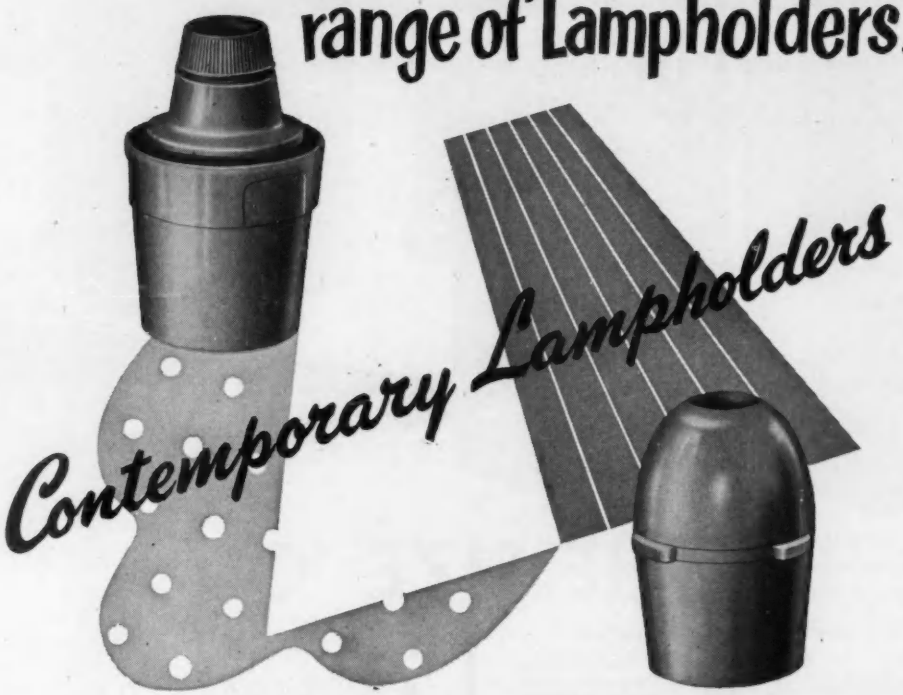
Electrical Overhead Steelwork

To British Standard Specifications and Special requirements

Tel. Wolverhampton 24691

WELLINGS, MALE & CO., LTD.
FALCON WORKS, CARTWRIGHT ST., WOLVERHAMPTON.

NETTLE Leads Again! with a new and exciting range of Lampholders..



for Contemporary Lighting Schemes . . .

For the first time a really contemporary design is available in domestic lampholders. Making a radical departure from traditional styling Nettle have produced these attractive fittings in White, Black and Dove Grey. The variety of interiors includes the well-known coarse-threaded porcelain.

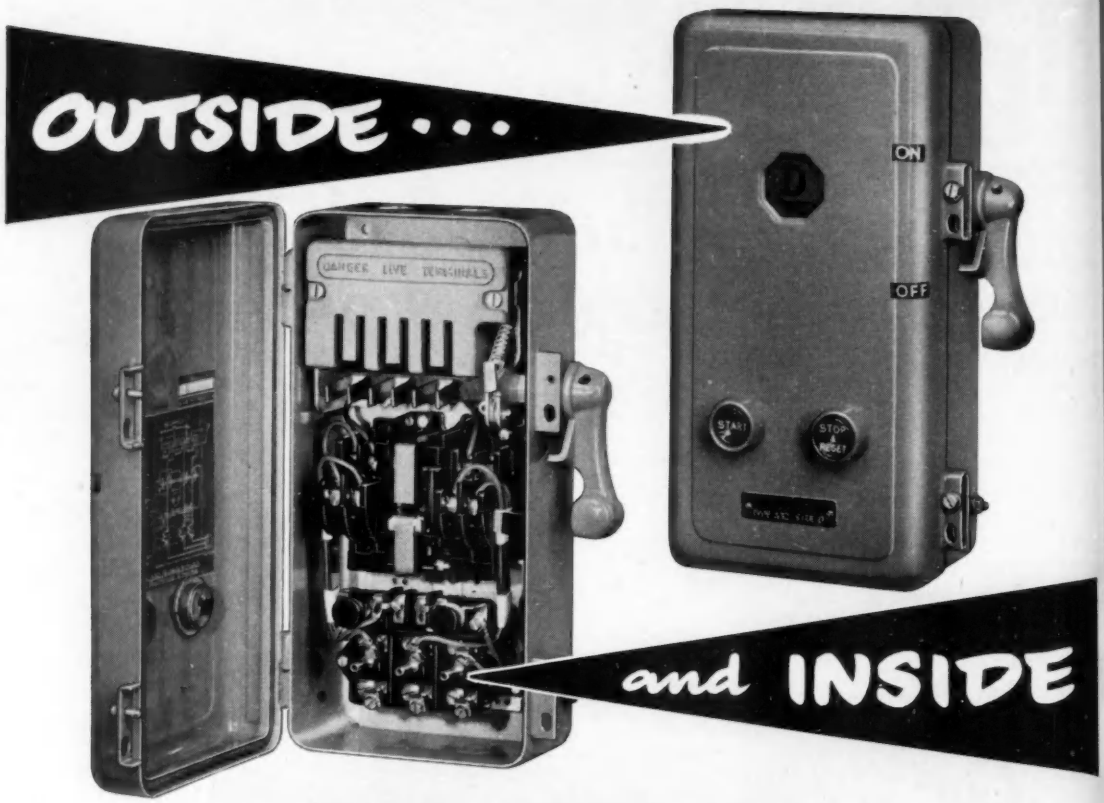
Selected by the Council of Industrial Design for display at the Design Centre . . .

Further details from

NETTLE ACCESSORIES LTD.

SALES DIVISION — WARREN STREET · STOCKPORT · CHESHIRE

MEMBER of the AERIALITE Group of COMPANIES



THE SIZE 'O'

And here are some of the MAIN reasons why . . .

Isolating switch, mechanically interlocked with lid. Interlock can be "defeated" for test and inspection and live parts are thus shielded when lid is open. The use of a starter with combined interlocked isolating switch, makes for SAFETY and ECONOMY. The latter because one piece of apparatus instead of two is used with consequent reduced installation costs. Other SUPPLEMENTARY reasons why this starter will meet with your approval are :—

Contactor starter interior, chassis mounted, and easily changed.

Thermal overload heaters for contactor starter, to suit different horse powers, easily fitted.

Isolating switch (load breaking type) will switch up to eight times current of maximum full load H.P., at power factors between ·2 to ·3. Switch is chassis mounted and can be padlocked On or Off.

The sheet steel case, bonderised before painting and stoving, has a "lift-off" lid for easy access and can be padlocked closed. Lid fitted with neoprene gasket.

Dimensions and rating data etc. :—

Box size only 11⅞" x 7" x 4½". Rating 3 h.p.–380/550. 3ph. Starters can be supplied with Start-Stop pushes in lid, or Overload reset button, or switch for "Auto-Off-Hand" control. Whole assembly complies with B.S.587, Contactors with B.S.775, and Isolating switch with B.S.61.

DONOVAN
A.C. DIRECT-ON-LINE
CONTACTOR STARTER
with
INTERLOCKED LOAD BREAKING
ISOLATING SWITCH

will meet with your approval!

ATTRACTIVELY DESIGNED AND FINISHED

THE DONOVAN ELECTRICAL CO. LTD.
GRANVILLE STREET, BIRMINGHAM 1

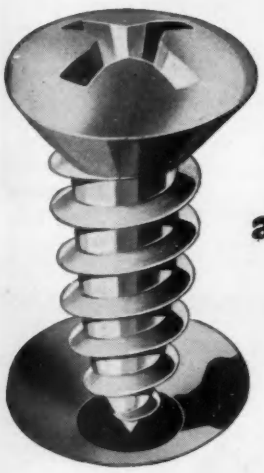
LONDON DEPOT : 149-151 YORK WAY, N.7 *GLASGOW DEPOT : 22 PITT STREET, C.2*

Sales Engineers available in LONDON, BIRMINGHAM, MANCHESTER, GLASGOW, BELFAST, BOURNEMOUTH

Manufacturers of Relays, Contactors, Automatic Starters, Control Accessories, Special Controllers and Control Centres, etc.

there is

a plain

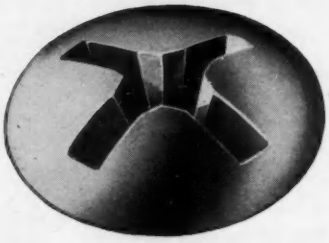


advantage

With steadily rising labour costs, every non-essential operation along the production line assumes increasing significance. One of these recurring operations has been the precision thread-cutting of screw holes, which, in assembly, have (equally precisely) to be registered together.

But the tapping, self-locating screw eliminates all this, and permits assembly by less-skilled labour. And the cross-recessed head version is designed for use with power-drivers—without a scratch of damage to worker or job. The tapping screw is demonstrably quicker—cheaper—stronger—safer than the conventional machine screw.

Such plain advantages pay such handsome dividends.

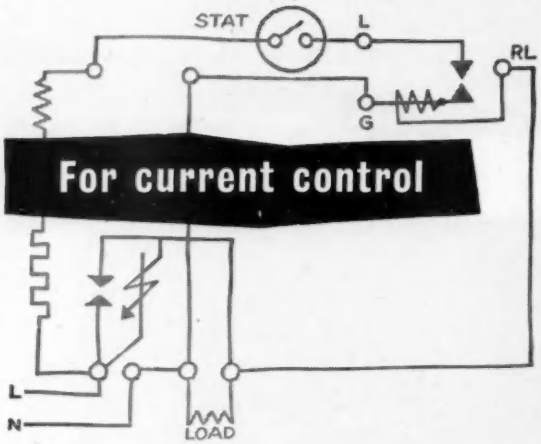


in tapping screws

Linread

SLOTTED AND PHILLIPS RECESSED HEAD MACHINE SCREWS AND TAPPING SCREWS HIGH TENSILE HEXAGON HEAD BOLTS AND SETSCREWS
AIRCRAFT BOLTS, SCREWS AND RIVETS · SEMP · RIVNUTS CUSTOM DESIGNED COLD FORGED FASTENERS · ALEX SCREWPLUGS

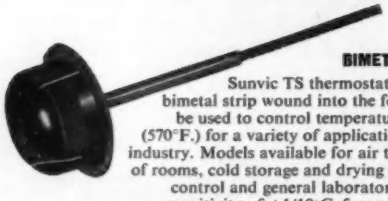
LINREAD LTD · COX ST · BIRMINGHAM 3



...SPECIFY SUNVIC

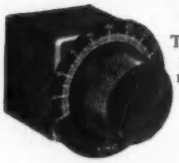
Sunvic components are widely used for controlling equipment such as moulding presses, furnaces, incubators, chemical plant, etc. Together with the Sunvic potentiometric recorder they also have numerous applications in scientific and industrial research particularly for measuring, controlling and recording temperature and small electrical quantities.

If you have a specific problem or would like technical information on any or all Sunvic components, please contact Sunvic Controls Ltd., P.O. Box 1, Harlow, Essex. Tel: Harlow 25271.



ADJUSTABLE BIMETAL THERMOSTATS

Sunvic TS thermostats are operated by a bimetal strip wound into the form of a helix. Can be used to control temperatures of up to 300°C. (570°F.) for a variety of applications in research and industry. Models available for air temperature control of rooms, cold storage and drying chambers, for oven control and general laboratory work, and with a sensitivity of ±1/10°C. for very accurate control.



ENERGY REGULATORS

The Sunvic energy regulator effects its control by periodically switching on and off the power, the ratio of the on-time to the total time determining the average power input, which is continuously variable. Available in several forms with a continuous rating of 1kW at 230V. A.C.; also supplied with an HVS relay for larger loads.

HOTWIRE VACUUM SWITCH (HVS) TUBES AND RELAYS

Available either as a loose tube for switching up to 10 kW at 400V. A.C. or D.C. or as a complete relay either enclosed in a plastic box or mounted on a paxolin base for incorporation in customer's own equipment. For single—or three-phase A.C. applications. Advantages are: no arcing; silent operation; low, non-inductive operating current; A.C. or D.C.; inductive or non-inductive loads.

SUNVIC

An A.E.I. Company

Control and research equipment for science and industry

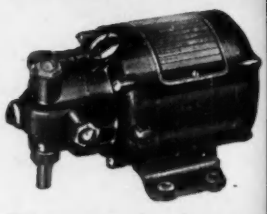
relays, thermostats, time delays, energy regulators, D.C. amplifiers and potentiometric recorders

SC/68

Citenco

WORLD FAMOUS FRACTIONAL HORSE-POWER GEARED MOTORS

Output-shaft has 12 positions. Integral Wormgear Reduction. Ventilated—Drip Proof. Vacuum Impregnated Windings. Dynamically balanced Armatures and Rotors.



SERIES WOUND GEARED MOTOR—Type 'K'

R.P.M.	TORQUE	R.P.M.	TORQUE
600	10 oz. in.	37.5	4 lb. in.
300	16 oz. in.	25	4 lb. in.
150	24 oz. in.	18.8	4 lb. in.
100	32 oz. in.	12.5	4 lb. in.
75	36 oz. in.	9.4	4 lb. in.
50	3 lb. in.	6.25	4 lb. in.

SHADED-POLE INDUCTION GEARED MOTOR—Type 'FA'

R.P.M.	TORQUE	R.P.M.	TORQUE
216	4 oz. in.	13.5	24 oz. in.
108	7 oz. in.	9	30 oz. in.
54	10 oz. in	6.7	35 oz. in.
36	12 oz. in.	4.5	44 oz. in.
27	15 oz. in.	3.35	3 lb. in.
18	20 oz. in.	2.25	4 lb. in.

VARIABLE SPEED GEARED MOTOR—Type 'KQ'

R.P.M.	TORQUE	R.P.M.	TORQUE
200-600	9 oz. in.	12-37.5	4 lb. in.
100-300	16 oz. in.	8-22	4 lb. in.
50-150	20 oz. in.	6-16.5	4 lb. in.
32-100	32 oz. in.	4-11	4 lb. in.
25- 75	40 oz. in	3- 8.25	4 lb. in.
16- 50	48 oz. in.	2- 5.5	4 lb. in.

CAPACITOR INDUCTION GEARED MOTOR—Type 'N'

R.P.M.	TORQUE	R.P.M.	TORQUE
456	8 oz. in.	28.5	3 lb. in.
228	13 oz. in.	19	4 lb. in.
114	21 oz. in.	14.2	4 lb. in.
76	26 oz. in.	9.5	4 lb. in.
57	32 oz. in.	7.1	4 lb. in.
38	44 oz. in.	4.75	4 lb. in.

CITY ENGINEERING CO. (Boreham Wood) LTD.

MANOR WAY - BOREHAM WOOD HERTS - ENGLAND

Telegrams: Citenco Borehamwood *Telephone:* Elstree 3666-7-8

RELAYS

NOW! A BRAND NEW 12 Changeover Magnetic RELAY

Enormous range of 3,000 P.O. Type Relays.
CONTACTS: 300 m/A to 8 amp.
COILS: Up to 100,000Ω.

P.O. 600 and High-Speed Type Relays. Built to Specification

LARGE STOCKS OF KEYSWITCHES

PROMPT DELIVERY

THE KEYSWITCH CO.

2 Irongate Wharf Rd., Praed St., London, W.2 PAD 2231/2/3

Contractors to Home and Overseas Governments and H.M. Crown Agents

ALDRIDGE

do a better job in plastics

If you want a better job done in plastics, Aldridge will do it. Take this new telephone for instance. Thanks in a great measure to the use of plastic mouldings manufactured by Aldridge, here is how it compares with the present conventional type :

- It is approximately 40% lighter
- costs 24% less for materials
- requires only 25% of the labour
- is produced 210% faster
- employs an 8 oz. injection machine instead of a 300 ton moulding press
- doesn't need to be 'de-flashed'
- holes can be punched instead of drilled
- made of tough, high impact polystyrene

Aldridge do a better job in plastics because they never stop thinking plastics, dreaming plastics and improving their techniques for manufacturing intricate, accurate shapes in plastics. Give them a product in another material—or even one already made in plastics—and it's pretty certain that they'll be able to give you a still better job in plastics. Let them see it in the design stage and they'll show you how it can be simpler, cheaper and better in plastics.

You are invited to get in touch with

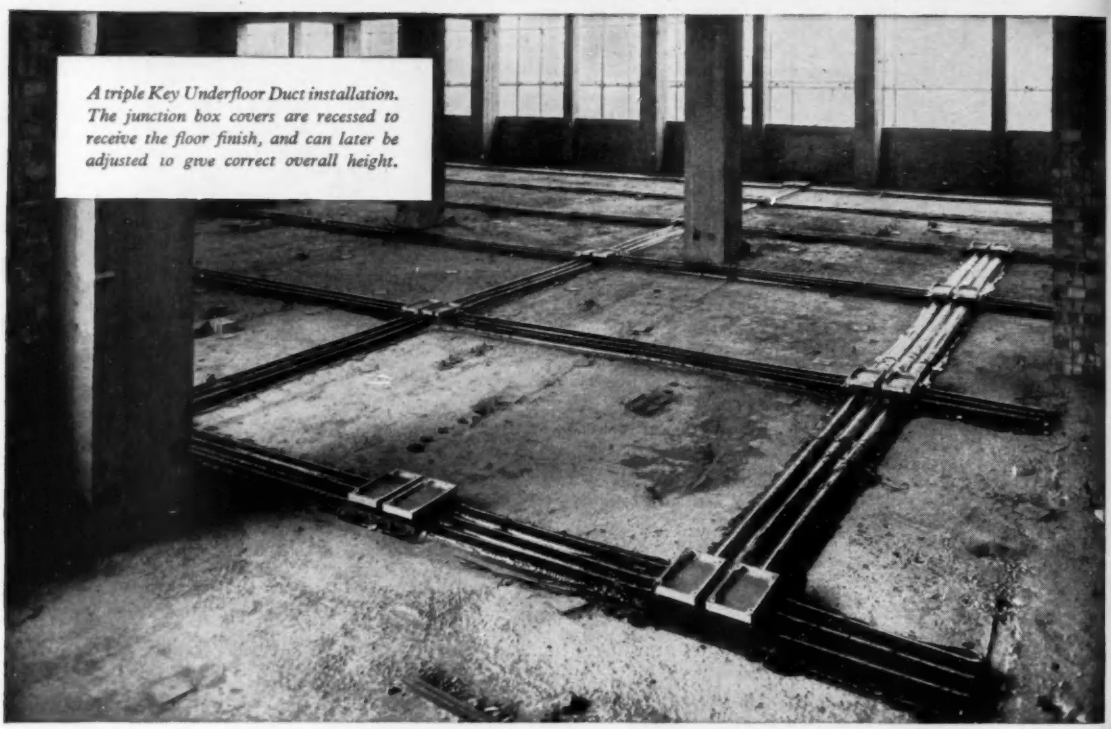
ALDRIDGE PLASTICS LTD

An A.E.I. Company

Redhouse Industrial Estate, Aldridge, Staffordshire
Tel: Aldridge 52031 (3 lines)
Sales Office: 155 Charing Cross Road, London, W.C.2
Tel: GERrard 4820 & 8660

CRC A1

Now and for the future—
Key Underfloor Duct
solves wiring problems economically



A triple Key Underfloor Duct installation. The junction box covers are recessed to receive the floor finish, and can later be adjusted to give correct overall height.

Electric power and telephone outlets can be installed and added as necessary when Key Fibre Underfloor Duct is used. On a materials plus labour basis the cost of installations is lower than any metal system. Because of their light weight and ease of cutting and fitting, Key ducts can be quickly laid. Since there is no necessity to pre-position outlets, the architect can install an underfloor duct scheme, and later fit outlets to suit the occupant's requirements. The fitting of these outlets is a quick and simple matter and the most complete range of fittings is available for lighting and telephone systems.

easy to lay—low cost
completely adaptable

KEY UNDERFLOOR DUCT
conforms with B.S. 815 and is the original Underfloor Duct System. Key have the widest experience of Underfloor Duct Systems in the U.K.

Speed the job—cut the cost with the

KEY **UNDERFLOOR DUCT SYSTEM**

ALSO KEY FIBRE CONDUIT FOR HEAVY DUTY CABLES

A PRODUCT OF **KEY ENGINEERING COMPANY LIMITED**
Elevator Road, Trafford Park, Manchester, 17. Telephone: Trafford Park 2056/7

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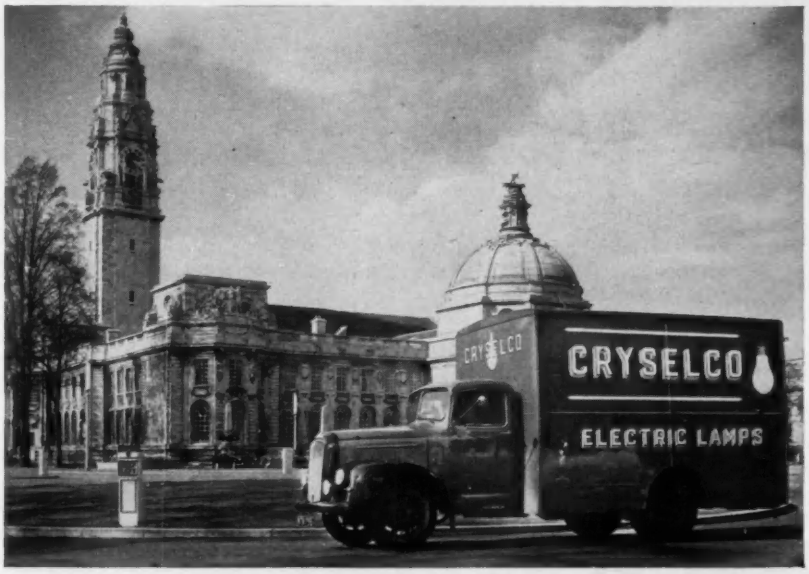
TGA UDI

Cryselco – at your service everywhere



CARDIFF CITY HALL In town or country, wherever you are, CRYSELCO'S national coverage ensures for you the best quality and prompt service for all your lamp and fittings requirements. There are branches waiting to serve you in fourteen towns and cities. Please write or telephone.

OVER SIXTY YEARS OF QUALITY AND SERVICE

CRYSELCO

MADE IN ENGLAND

Lamps FOR ALL PURPOSES

OUR ILLUMINATING ENGINEERING DEPARTMENT
IS AVAILABLE TO GIVE CUSTOMERS PROMPT HELP AND SERVICE

Branches BIRMINGHAM · BRISTOL · BURY ST EDMUNDS · CARDIFF · GLASGOW · LEEDS
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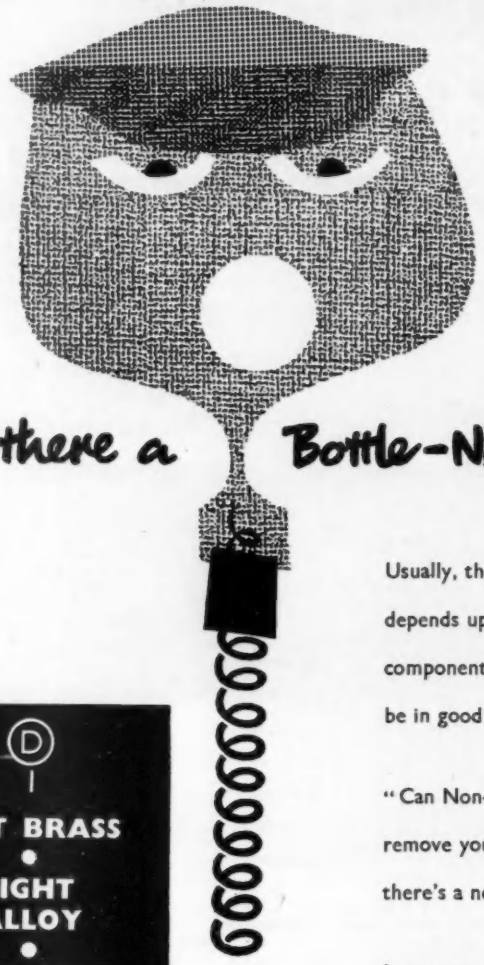
QUALITY The foundation of CRYSELCO SALES

CRYSELCO LIMITED KEMPSTON WORKS BEDFORD



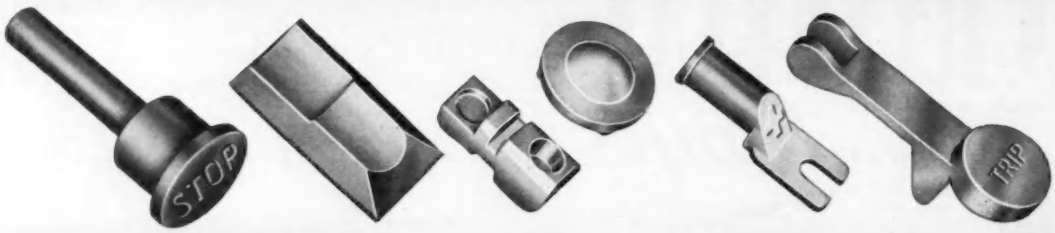
is there a Bottle-Neck in your works?

Usually, the flow of production in an assembly depends upon the "little chaps" among the components . . . bits and pieces that simply must be in good supply.

"Can Non-Ferrous Stampings and Hot Pressings remove your bottle-neck? . . . . If so, we suggest there's a need for our services."

In any case, why not write us?

HOT BRASS
•
LIGHT ALLOY
•
ALUMINIUM BRONZE PRESSINGS



BRASS & ALLOY PRESSINGS (DERITEND) LIMITED

Specialists in NON-FERROUS STAMPINGS & HOT PRESSINGS

LIVERPOOL STREET - BIRMINGHAM, 9

Tel: VICTORIA 2941

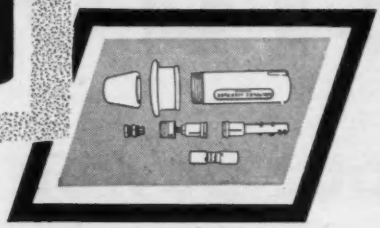
ONE OF THE DERITEND GROUP OF COMPANIES

Aeroflex

LINE FUSES

The two types of Line Fuses, differing only in connection, meet a steady demand, for instance, in the protection of pole-mounted transformers. Incorporating Aeroflex AD and FC type rewireable cartridge fuse-links, they have the characteristics necessary to provide discriminatory reaction to faults; e.g. priority can be given to consumers' fuses on house service cut-outs.

The subject is fully dealt with in our publication No. AL2.



OVERHEAD LINE FUSES

The illustration shows examples from a considerable range of overhead line fuses to suit different situations:—on the left an Aeroflex 60 amp. Rotaloc line fuse is shown, suitable for securing to the cross bar of a line support, and having an adaptable fuse handle carrying an Aeroflex high breaking capacity 60 amp. ADS type rewireable cartridge fuse-link. The right hand illustration shows a 200 amp. porcelain enclosed line fuse, embodying Link Type handle with Aeroflex Ceram high breaking capacity rewireable cartridge fuse-link.

Parmiter Hope & Sugden Ltd.

FLUVENT ELECTRICAL WORKS · LONGSIGHT · MANCHESTER 12

London: 34 Victoria Street, S.W.1. Glasgow: 5 Somerset Place, C.3. Birmingham: 39/41 Carrs Lane, 4.

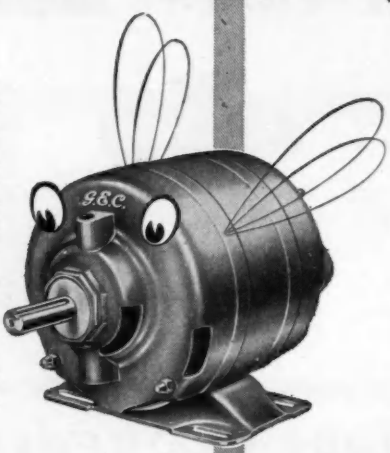
dmPH142

G.E.C.

Fractionals

put power where you want it

Power for many purposes. Power to drive your own plant efficiently, or to add further distinction to the equipment you make and sell. Power. As much (up to 1 h.p.) or as little as you need, in a wide range of mountings, but always with the reliability for which all G.E.C. engineering is famous. Power, from sturdy, dependable G.E.C. Fractionals. Most sizes and mountings are held in stock—that's another advantage of dealing with the G.E.C.



G.E.C. manufacture many types and sizes of fractional motors for light industrial and domestic drives—whether for your plant or products our engineers will always be pleased to help you choose the right motor for the job.

Fully detailed illustrated publication on application.

The Busy Bee from G.E.C.

THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

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CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Advertisements are accepted up to first post on Monday of the week of issue

If displayed with boxed rules, name or symbol block by Friday prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

CHRISTMAS

Classified Advertisements for the issue of 19th December should reach us by FIRST POST on FRIDAY, 12th DECEMBER

OFFICIAL NOTICES, TENDERS, ETC.

COUNTY BOROUGH OF SOUTHEND-ON-SEA

Proposed Electrical Installation at Westborough Junior School

TENDERS are invited for the performance of works in connection with the proposed Electrical Installation at Westborough Junior School.

General conditions of contract and drawings may be inspected, and copies of form of tender, specification and drawings obtained on application to the Borough Architect, 30, Alexandra Street, Southend-on-Sea.

Sealed tenders addressed to the undersigned and endorsed "Proposed Electrical Installation, Westborough Junior School," are to be delivered to this office before 3 p.m. on Monday, 29th December, 1958, and no tender received thereafter will be considered.

No tender will be received except in the special envelope provided, which shall not bear any name or mark indicating the sender.

The Corporation do not bind themselves to accept the lowest or any tender.

ARCHIBALD GLEN,
Town Clerk. 5693

BOROUGH OF SUTTON COLDFIELD

Trunk Road A.38, Lichfield Road

Street Lighting

TENDERS are invited for the supply and erection of Sodium Vapour Lamps and Lanterns for a section of centrally suspended lighting system, the taking up and refixing of existing steel columns and the supply and erection of new steel columns, with lanterns, etc., having a mounting height of 25 ft.

Contract documents may be obtained from and plans inspected at the Borough Surveyor's Office, Council House, Sutton Coldfield. A deposit of £2 is required in respect of the documents, which will be returned on receipt of a bona fide tender not subsequently withdrawn.

Tenders, in plain sealed envelopes, endorsed "Lichfield Road Street Lighting," to be delivered to the undersigned not later than 12 noon on the 1st January, 1959.

R. WALSH,
Council House, Town Clerk.
Sutton Coldfield.
27th November, 1958. 5672

COUNTY OF CORNWALL

APPLICATIONS are invited from Electrical Contractors for permission to tender for the ELECTRICAL SERVICES Sub-Contract in connection with the erection of a new County Secondary School at NEWQUAY and at LISKEARD.

Applications should be made to the County Architect, County Hall, Truro, not later than Saturday, 13th December, 1958, from which a selected number of firms will be invited to tender.

The closing date for receipt of tenders will be notified when the documents are despatched.

The lowest or any tender will not necessarily be accepted nor will the County Council pay to contractors any fees or expenses incurred in the preparation of tenders.

E. T. VERGER,
Clerk of the County Council.
County Hall, Truro.
28th November, 1958. 5692

ALKALI, &c. WORKS (SCOTLAND) ORDER, 1958

Registration under the Alkali, &c., Works Regulation Act, 1906

WITH effect from 31st December, 1958, the Alkali, &c., Works (Scotland) Order, 1958 (S.I. 1958 No. 1932 (S.105)*) further extends and amends the list of works scheduled under the Alkali, &c., Works Regulation Act, 1906, by the addition of, among others, the classes of works set out in the schedule hereto.

From 31st December no work of a class named in the order may, by virtue of section 9 of the Act, be carried on unless certified to be registered by the Secretary of State for Scotland.

The term "works" refers to the operations or processes specified in the schedule and not necessarily to the whole of the premises in which they are carried on.

Application for registration should be made forthwith by letter addressed to the Secretary, Department of Health for Scotland, St. Andrew's House, Edinburgh, 1.

The following particulars should be stated:—

(a) Description of each work requiring registration (e.g., steel works—Bessemer furnaces);
(b) (i) Name, if any, of the premises at which the work is or will be carried on;
(ii) Full postal address of the premises;
(iii) Burgh or county in which the premises are situated.
(c) Name and address of:
(i) the owner;
(ii) the lessee, occupier or other person carrying on the work(s).
(d) The date(s) of installation of the plant(s).

The application should be made by or on behalf of the company or person actually carrying on the work.

Cheques or money orders in payment of the registration fee (£6) should not be forwarded until requested.

*Obtainable at H.M.S.O., price 3d. net.

SCHEDULE.

Electricity Works, that is to say, works in which—

(a) solid or liquid fuel is burned to raise steam for the generation of electricity for distribution to the general public or for purposes of public transport; or
(b) boilers having an aggregate maximum continuous rating of not less than 450,000 lb. of steam per hour and normally fired by solid or liquid fuel are used to produce steam for the generation of electricity for purposes other than those mentioned in the preceding paragraph.

Dated this 27th day of November, 1958.
Department of Health for Scotland.
5691

HONITON BOROUGH COUNCIL

Lighting Equipment

TENDERS are invited for the supply of Chokes, Capacitors, Lamps, Time Switches and Steel Columns.

Specifications and bills of quantities may be obtained from the Borough Surveyor. Tenders endorsed "Lighting" must be received by the undersigned not later than the 31st December, 1958.

H. V. CUSTANCE,
Municipal Offices, Town Clerk.
New Street,
Honiton, Devon. 5642

NOBLE'S ISLE OF MAN HOSPITAL

Central Heating Station, Multi-Purpose Ward Block and Twin Operating Theatre Unit

To Registered Electrical Contractors

REGISTERED Electrical Contractors who desire to tender for work in connection with the

Sub-Contract (a) Central Heating Station, and/or

Sub-Contract (b) Multi-Purpose Ward Block and Twin Operating Theatre Unit

being erected on the Hospital site in Westmoreland Road, Douglas, are invited to submit their names for consideration.

The installation, particularly in the case of (b), is complex and of very considerable size, and only contractors who have sufficient labour and resources to undertake such work should submit their names. A team of six pairs will be required in connection with (b), all of whom must be very experienced men in their trade. The names of architects to whom reference can be made in respect of works carried out by contractors should be stated in the application. The plans and specifications may be inspected at the office of the Hospital's Architect, Mr. W. T. Quayle, F.R.I.C.S., F.I.A.A., 29, Athol Street, Douglas. The names of the contractors will be given full consideration and a selected list will then be asked to submit firm tenders.

Applications to be submitted to the undersigned on or before noon of Monday, 8th December, 1958.

E. C. KNEALE,
Secretary, Hospital Management Committee.
Noble's Isle of Man Hospital,
Douglas, Isle of Man.
18th November, 1958. 5616

CITY OF NORWICH

Sewage Purification Works, Whitlingham Sludge and Stormwater Pumping Equipment

TENDERS are invited on a fixed price basis for the supply and erection of the following equipment:—

(1) 2 1,500-g.p.m. centrifugal sludge pumps with electric motors.
(2) 2 2,600-g.p.m. centrifugal stormwater pumps with electric motors.
(3) Automatic control and switchgear, pipework and ancillary equipment for the above sets.

Documents may be obtained from the City Engineer, City Hall, Norwich, and sealed tenders must be returned by noon on the 8th January, 1959. 5713

SITUATIONS VACANT

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division :—

ASSISTANT MAINTENANCE ENGINEER (Mechanical), STAYTHORPE POWER STATION (Vacancy No. 172/58/ER).

Applicants should have received a sound technical training and have had wide practical experience in the maintenance of power station mechanical plant. A house may be made available if the successful applicant so desires.

The salary will be in accordance with Class K, Grade 7 (£1,160-£1,235 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

FOURTH ASSISTANT ENGINEER, STAYTHORPE TRANSMISSION SECTION (Vacancy No. 173/58/ER).

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformer and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

The following vacancies are at High Marnham Power Station, which is now under construction. The ultimate capacity of this station will be 1,000 MW. The power station is situated in a rural area on the River Trent, approximately fourteen miles south of Gainsborough and five miles east of Tuxford in the county of Nottinghamshire.

OPERATION SUPERINTENDENT, HIGH MARNHAM POWER STATION (Vacancy No. 175/58/ER).

Applicants should have wide experience of the operation and maintenance of a large modern power station with P.F. boiler plant. The successful applicant will be responsible to the Station Superintendent for ensuring that all sections of the plant attain the specified efficiency and for the carrying out of special investigations and tests.

The possession of the Higher National Certificate or equivalent would be an advantage.

The salary will be in accordance with Class L, Grade 4 (£1,560-£1,665 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

MAINTENANCE ENGINEER (Electrical), HIGH MARNHAM POWER STATION (Vacancy No. 177/58/ER).

Applicants should have had a good general education and technical training. A wide experience in the maintenance of E.H.T. switchgear and power station electrical auxiliaries is essential.

Qualifications entitling to graduate membership of the Institution of Electrical Engineers would be an advantage.

The salary will be in accordance with Class L, Grade 5 (£1,435-£1,540 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

MAINTENANCE ENGINEER (Mechanical), HIGH MARNHAM POWER STATION (Vacancy No. 178/58/ER).

Applicants should have had a good general education and a fundamental training in mechanical engineering including workshops, and should preferably have had experience in the maintenance of mechanical plant as installed in a modern power station.

Qualifications entitling to graduate membership of the Institution of Mechanical Engineers would be an advantage.

The salary will be in accordance with Class L, Grade 5 (£1,435-£1,540 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

SHIFT CHARGE ENGINEERS, HIGH MARNHAM POWER STATION (Vacancy No. 176/58/ER).

Applicants should have had a sound technical training and considerable experience in a large modern power station. The possession of the Higher National Certificate or equivalent would be an advantage.

The salary will be in accordance with Class L, Grade 6 (£1,325-£1,415 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 10th December, 1958.

STATION SHIFT CONTROL ENGINEERS, HIGH MARNHAM POWER STATION (Vacancy No. 174/58/ER).

Applicants should have had a sound technical training and practical experience in a modern power station. Preference will be given to applicants who possess the Higher National Certificate or its equivalent.

The salary will be in accordance with Class L, Grade 10 (£995-£1,055 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 10th December, 1958.

FOURTH ASSISTANT ENGINEER, TECHNICAL DEPARTMENT (Vacancy No. 179/58/ER).

The minimum technical qualification required is the Higher National Certificate in Electrical Engineering, and preference will be given to candidates who have completed a recognised postgraduate apprenticeship.

Experience of higher voltage switchgear and protective gear will be an advantage.

The successful candidate will be required to reside in or near Leicester.

The salary will be in accordance with Class AX/EX, Grade 8 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th December, 1958.

These appointments will be pensionable under the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

O. S. WOODS,
Divisional Controller.

26th November, 1958. 5677

YORKSHIRE ELECTRICITY BOARD

Head Office

TRAINEE CONTROL ENGINEERS.

Trainee Shift Control Engineers are required for training as Shift Control Engineers at the Board's regional control centres.

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers or should possess the necessary or equivalent qualifications; they should have had good general field operation experience on underground and overhead systems.

The successful applicants may be required to work at any of the Board's five regional control centres.

Salary N.J.B. Scale AX-EX, Grade 6 (plus 10% shift enhancement), £984 10s. × £27 10s. to £1,122 rising to £1,254.

Applications, quoting H.O.R., and giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Secretary, Head Office, Yorkshire Electricity Board, Wetherby Road, Scarcroft, near Leeds, not later than 19th December, 1958.

No. 3 (Sheffield) Sub-Area

In connection with the establishment of new Engineering Districts in the No. 3 (Sheffield) Sub-Area, vacancies exist for engineering staff as follows :—

(1) SECOND ASSISTANT ENGINEERS, SHEFFIELD CENTRAL, SHEFFIELD WEST, SHEFFIELD EAST and ECCLESFIELD DISTRICTS.

Applicants should have had considerable experience in the work of a District Engineering Department and they should be competent to take charge of an Operational Unit or Reinforcement and Planning Section.

(2) THIRD ASSISTANT ENGINEERS, SHEFFIELD CENTRAL, SHEFFIELD WEST, SHEFFIELD EAST and ECCLESFIELD DISTRICTS.

Applicants should have had experience in the work of a District Engineering Department, including construction, operation, maintenance or system planning.

(3) FOURTH ASSISTANT ENGINEERS, SHEFFIELD CENTRAL and SHEFFIELD WEST DISTRICTS.

Applicants should have had suitable engineering training, preferably including some experience in a District Engineering Department.

The minimum technical qualification required for these vacancies is Graduateship of the Institution of Electrical Engineers or its equivalent :—

The appropriate salaries for these positions are :—

SHEFFIELD CENTRAL, WEST and EAST, Class H.
Second Assistant Engineer, N.J.B. Grade 7, £995/£20/£1,055 p.a.
Third Assistant Engineer, N.J.B. Grade 9, £885/£15/£930 p.a.
Fourth Assistant Engineer, N.J.B. Grade 11, £790/£15/£835 p.a.

ECCLESFIELD DISTRICT, Class F.
Second Assistant Engineer, N.J.B. Grade 7, £885/£15/£930 p.a.
Third Assistant Engineer, N.J.B. Grade 9, £790/£15/£835 p.a.

There is considerable large-scale development in hand in these Districts and the posts offer excellent opportunity to acquire very heavy industrial experience. Sheffield, despite its heavy industries, lies on the edge of the Peak National Park with attractive residential areas.

Applications, quoting 3 SAR, and giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 19th December, 1958.

No. 5 (Wakefield) Sub-Area

CASTLEFORD DISTRICT.

THIRD ASSISTANT DISTRICT ENGINEER. Applicants should have had practical training and experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution network, substation plant and ancillary equipment.

Candidates should preferably have attained the technical standard of the Higher National Certificate in Electrical Engineering or equivalent qualifications. Candidates must be prepared to reside in the District and undertake standby duties.

Salary N.J.B. Class F, Grade 9, £790/£15/£835 per annum.

Applications, quoting 5 SAR, and giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 12, Denby Dale Road, Wakefield, not later than 19th December, 1958. 5697

ELECTRONICS

Are you one who likes to work on your own, develop new ideas and apply electronic techniques to an interesting range of products?

Stone-Chance Ltd., at their Crawley factory in Sussex, offer this opportunity to a man whose age or qualifications are of secondary importance to his ability to think originally.

A good salary will be paid with assistance given towards housing in the area.

All applications treated in confidence, to be made direct to Managing Director.

5655

ELECTRICAL ENGINEERS

required for Technical Tendering Department of Automatic Motor Control Gear Makers in West Midlands.

The work comprises the initial engineering of control schemes, the calculation of their cost and the preparation of tenders.

A pension scheme is in operation and assistance towards removal expenses will be paid in approved cases.

Apply in confidence stating age, experience and salary required to—Box 5591.

A.E.I.—HOTPOINT LIMITED

ASSISTANT TO THE CHIEF HOUSECRAFT ADVISER

A vacancy exists in this successful and expanding Company for an Assistant to the Chief Housecraft Adviser.

The person appointed to this position will report directly to the Chief Housecraft Adviser and will be responsible for all aspects of the administrative work involved in the employment of a large force of Sales Demonstrators. The post also demands the ability to demonstrate domestic electrical equipment at important functions and to organise special exhibitions and demonstrations. The area of operation is national and will involve some travel throughout this country, though a considerable part of the activities will be centred in the London area.

Applicants should be women between the ages of 27 and 37 holding a domestic science qualification and preferably an E.A.W. Diploma, and they should have considerable experience in the electrical industry.

The post demands a high level of qualification and experience and there will be an appropriate salary and conditions of employment.

Applications should be addressed to the :—

Personnel Manager

A.E.I.—HOTPOINT LIMITED

33 Grosvenor Place, London, S.W.1 5686

WARWICKSHIRE EDUCATION COMMITTEE

Rugby College of Engineering Technology

APPLICATIONS are invited for the following posts in a rapidly expanding College dealing with full-time industry-based sandwich courses only, leading to London External Degrees in Engineering and College Diplomas.

New and up-to-date laboratories are planned and are under construction.

Teaching time-tables are so framed as to allow unusual opportunities for research and industrial contact.

Applications need not be limited to those having considerable teaching experience, but a University Degree, together with good industrial or research experience, is expected.

(1) SENIOR LECTURERS IN ELECTRICAL ENGINEERING:
Two vacancies arise, one of which carries, by Ministry of Education consent, a scale maximum of £150 in excess of the Burnham agreed salary, which is £1,350 × £50 to £1,550 for Senior Lecturers.
Special qualifications in Electrical Machines or Control Systems will be a recommendation.

(2) LECTURERS (Two) IN ELECTRICAL ENGINEERING:
These posts in light or heavy current work offer a unique opportunity to young men of high qualifications wishing to gain teaching experience with close industrial contacts.
Salary in accordance with the Burnham Technical Report, £1,200 × £30 to £1,350.

Further particulars and application forms may be obtained from the Principal, to whom replies should be addressed as soon as possible.

W. COOPER,
Principal.

Rugby College of Engineering Technology,
Eastlands, Rugby.
November, 1958. 5645

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

CONSUMERS' ENGINEER required to operate from Birkenhead in North Wirral District. Salary within range £935/£995 per annum (N.J.B. H/8).

Technical training and qualifications desirable.

Duties will include the development of industrial, commercial and domestic supplies, and supervision of work on consumers' premises.

Appointment subject to medical examination. Pension scheme.

Applications, on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate Street, Chester, should be returned not later than 17th December, 1958. 5644

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of I.E.E. or I.Mech.E. an advantage.

SHIFT CHARGE ENGINEER, HAMMERSMITH POWER STATION (Vacancy No. 58/999).
Sound technical training and practical experience in the operation and maintenance of boilers, turbines and E.H.T. switchgear. Salary Class D, Grade 7 = £830 plus £79 shift p.a.

GENERAL ASSISTANT ENGINEERS (Power and Development Sections), TECHNICAL DEPT., DIV. H.Q. (Vacancy No. 58/1000).
Works experience in manufacture and testing of electrical equipment used in power stations and on high-voltage transmission system. Experience in commissioning or maintenance of such plant, including protective gear, an advantage. Also knowledge of, or aptitude for, protective gear work or shirt circuit calculations. Salary Class AX/EX, Grade 9 = £590/£745 per annum.

FOURTH ASSISTANT ENGINEERS (Power and Development Sections), TECHNICAL DEPT., DIV. H.Q. (Vacancy No. 58/1001).
Experience in manufacture and testing of electrical equipment used in power stations and on high-voltage transmission system. Experience in commissioning or maintenance of such plant, including protective gear, an advantage. Also aptitude for short circuit and load flow calculations on complex A.C. networks. Salary Class AX/EX, Grade 8 = £750/£985 p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 15th December, 1958. 5659

DRAUGHTSMAN FOR MEDIUM-VOLTAGE CIRCUIT BREAKERS

WE are looking for a draughtsman, with sound knowledge of medium-voltage air break circuit breakers, to fill a position that offers excellent opportunities for a man of initiative, capable of working with the minimum supervision.

Our staff work a five-day week in modern offices and participate in a non-contributory pension scheme.

Apply in writing, giving full details, to :—

The Personnel Manager
GEORGE ELLISON LIMITED
Perry Barr, Birmingham, 22b
5662

CENTRAL ELECTRICITY GENERATING BOARD

Yorkshire Division

APPLICATIONS are invited for the following appointments in the Technical Department of the Yorkshire Division.

(a) SECOND ASSISTANT ENGINEER, SYSTEM DESIGN SECTION, BASED ON DIVISIONAL HEADQUARTERS, LEEDS.
Applicants should have sound experience of the application of control and protective gear equipments to large generating stations and transmission systems and be experienced in preparing and examining electrical diagrams in connection with the same.

(b) THIRD ASSISTANT ENGINEERS, SYSTEM DESIGN SECTION, BASED ON DIVISIONAL HEADQUARTERS, LEEDS.
Applicants should have some experience similar to that required for (a) or be experienced in the planning of, and calculations relating to, H.V. networks.

(c) THIRD ASSISTANT ENGINEER, PROTECTION SECTION, BASED ON WHITEHALL ROAD, LEEDS.
Applicants should be experienced in the testing, commissioning and maintenance of control and protective gear equipments in large generating stations and transmission systems, and in investigating faults on primary equipment.

(d) FOURTH ASSISTANT ENGINEERS, PROTECTION SECTION, BASED ON VARIOUS LOCATIONS IN THE DIVISION.
Applicants should have some experience similar to that required for (c).

(e) FOURTH ASSISTANT ENGINEER, SYSTEM DESIGN SECTION, BASED ON DIVISIONAL HEADQUARTERS, LEEDS.
Applicants should have some experience in the calculations relating to H.V. network planning.

For all appointments applicants should have technical qualifications leading to Corporate Membership of the Institution of Electrical Engineers. Works experience will be an advantage.

Salaries for these appointments will be within the following grades of the National Joint Board Agreement, Schedule B :—
(a) Grade 4, £1,145–£1,270 per annum rising to £1,410 per annum.
(b) & (c) Grade 6, £895–£1,020 per annum rising to £1,140 per annum.
(d) & (e) Grade 8, £710–£835 per annum rising to £935 per annum.

Application forms obtainable from the Divisional Secretary (Establishments), Central Electricity House, St. Mary's Road, Leeds, 7, to be returned within 14 days of the appearance of this advertisement. 5684

SEYCHELLES ELECTRICITY DEVELOPMENT SCHEME

ELECTRICAL ENGINEER required on contract for one tour of 12/18 months in first instance. Salary according to qualifications and experience between £1,500 and £1,800 a year. Gratuity at rate of £150 a year. Free passages for officer and wife and assistance towards children's passages. Liberal leave on full salary.

Candidates, not more than 45 years of age, must be Corporate Members of the Institution of Electrical Engineers. They must be capable of undertaking responsibility for the installation and commissioning of all electrical and mechanical works required in connection with a new A.C. electricity supply undertaking at Port Victoria having 400 kWs of diesel generating plant to replace an existing D.C. installation. They must be able to advise potential consumers as necessary concurrently with the main construction work, supervise the testing and connection of new consumers' installations, and organise the change-over to A.C. supply of consumers connected to the existing D.C. supply. Ability to instruct as well as supervise semi-skilled and unskilled labour essential. Overseas experience in similar capacity an advantage.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/50344/EF. 5649

***Situations Vacant** (continued)*

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

Central Gloucestershire Sub-Area

SECOND ASSISTANT ENGINEER (Stroud).

Experience necessary in all branches of distribution work including construction, maintenance and operation of high and low voltage systems and substations, and the planning of system reinforcements and mains extensions. Experience of changeover from 6.6 to 11 kV an advantage. Technical qualifications desirable. Salary £835/£880 per annum. N.J.B. Class E, Grade 7.

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER (Dean Forest).

Applicants should have a sound commercial background including a thorough knowledge of industrial, commercial and rural development work. Technical qualifications desirable. Salary £790/£835 per annum (N.J.B. Grade E.8).

Apply by letter within 14 days, stating age, experience, present position and salary, to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, 126, London Road, Gloucester.

North Staffs Sub-Area

GENERAL ASSISTANT DISTRICT ENGINEER (Stone/Market Drayton).

The successful applicants will be required to assist in all branches of distribution work, including construction, operation and maintenance of H.V./L.V. overhead and underground mains and substations. Technical qualifications desirable. Salary £635/£680 per annum (N.J.B. Grade E.11).

Apply by letter within 14 days, stating age, experience, salary and present position, to Mr. C. C. Pimble, Sub-Area Manager, Midlands Electricity Board, 234, Victoria Road, Fenton, Stoke-on-Trent.

Shropshire and Herefordshire Sub-Area

CONTROL ENGINEERS (2) required at Sub-Area Headquarters to assist in the operation of the control room. Experience of operating a system control up to 66 kV will be an advantage. The successful candidates will normally be expected to work alternating morning and afternoon shifts on week-days. Salary per annum £790/£835 (N.J.B. Grade H.11), plus 10% shift enhancement.

Apply by letter within 14 days, stating age, experience, present salary and position to Mr. W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

A. STEPHENS,
Secretary. 5714

SOUTHERN ELECTRICITY BOARD

Assistant Branch Commercial Superintendent

Ealing District of No. 1 (Southall) Sub-Area, located at the Acton Branch. Salary N.J.B. Class H, Grade 9 (£935-£980 per annum, inclusive of London allowance). N.J.B. conditions of service.

Applicants should be capable of dealing with the normal tariff and supply queries, preparing estimates when required and supervising the contracting work in the Branch. and will be required to assist the Branch Commercial Superintendent in any of his duties.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.966, not later than 15th December, 1958.

Assistant Engineer (Planning)

Swindon District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class F, Grade 11, Schedule A (£685-£730 per annum). N.J.B. conditions of service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and to undertake standby duties if required. Suitable technical qualifications are necessary.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks, and returned to him, quoting Z.961, not later than 15th December. 1958.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. 5696

SHIFT ELECTRICAL FOREMEN

Shift Electrical Foremen are required in a new Bessemer Plant.

The successful candidates will be responsible for the supervision of electrical maintenance work within the plant.

Applicants should have served a craft apprenticeship. Ordinary National Certificate desirable, but good practical experience essential.

Those wishing to apply should write giving full details of age, experience, qualifications and any further information considered relevant to :—

Superintendent, Personnel Services

THE STEEL COMPANY OF WALES LIMITED

(Steel Division)

Abbey Works, Port Talbot, Glam. 5685

CENTRAL ELECTRICITY GENERATING BOARD

PHYSICISTS or ELECTRICAL ENGINEERS required at RESEARCH LABORATORIES, LEATHERHEAD, SURREY, for research on the generation and control of heavy currents and on gas discharges.

Candidates should have a good Honours Degree and previous research experience in gas discharge phenomena is desirable.

Salaries on a scale within the overall ranges £1,490-£1,945 or £550-£1,265, according to duties and responsibilities.

Ref. ER/364. Closing date 22nd December.

PRINCIPAL ASSISTANT ENGINEERS and ASSISTANT ENGINEERS required in the DEVELOPMENT POLICY SECTION of the PLANNING DEPARTMENT at HEADQUARTERS, LONDON, S.E.1.

The Section is directly responsible to the Chief Planning Engineer for long-term study of economic utilisation of resources needed for the generation of electricity, such as fuel, water and transport. Associated with this work is liaison with outside authorities, contributing to the work of committees and advising on the effects of new legislation and recommendations of official committees on the Board's generation development. The Section also contributes to the formulation of long-term generation plans, and advises on certain specialised technical and economic problems, e.g., the discharge of liquid and gaseous effluents from power stations.

Candidates should have the capacity for forward thinking and ability to show initiative on long-term technical policy work. For the higher posts they should also possess an honours degree or requisite qualifications for corporate membership of a senior professional institution.

Salaries :

Principal Assistant Engineers, £1,960-£2,160 p.a.

Assistant Engineers, on scales within the range £870-£1,900 p.a. according to duties and responsibilities.

Ref. ER/366. Closing date 23rd December.

Application forms for the above positions obtainable from I. G. Ellis, Personnel Officer, 24-30, Holborn, London, E.C.1, should be completed, quoting the appropriate reference, and returned by date stated. Please mark envelope "Confidential." 5643

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Division

Appointment of Station Chemist, Dunston "A" and "B" Power Stations

APPLICATIONS are invited for the appointment of STATION CHEMIST at Dunston "A" and "B" Power Stations.

Applicants should have good experience in modern analytical and physical chemistry and be conversant with boiler feed and water treatment. The possession of a good University Degree in Chemistry or A.R.I.C. is desirable.

The salary for the appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule A, Grade 6, Class K (£1,235-£1,325 per annum).

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Generating Board, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than 16th December, 1958. 5683

SOUTH EASTERN ELECTRICITY BOARD

CARTOGRAPHIC DRAUGHTSMAN, Croydon and West Kent Sub-Area Headquarters, Croydon.

Salary £680 × £20 to £740 per annum, including London allowance, under N.J.C. Grade 2. Superannuable. Applicants should have experience in the preparation of mains records, schematic diagrams, wiring diagrams and general drawing office routine. A knowledge of substation layouts would be an advantage.

Applications, quoting reference TER and naming 2 referees, on forms from Croydon and West Kent Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 15th December, 1958.

JOINTERS (Extra High Tension), West Kent District.

Wages 5s. 0½d. per hour, plus 8s. 3d. per week productivity award after one month's service for 44-hour 5-day week under N.J.I.C. Agreement. Applicants should be experienced in all classes of medium voltage and 11,000 volt jointing on underground cables, including transformer and switchgear connections and M.V. fuse units, disconnecting boxes, etc.

Applications, quoting reference TER and naming 2 referees, to District Manager, SEEBOARD, 286, High Street, Orpington, Kent, by 15th December, 1958.

JOINTER (Extra High Tension), Worthing District.

Wages 4s. 8½d. per hour, plus 8s. 3d. per week productivity award after one month's service for 44-hour 5-day week under N.J.I.C. Agreement. Applicants should be experienced in all classes of medium voltage and 11,000 volt jointing on underground cables, transformers and switchgear.

Applications, quoting reference TER and naming 2 referees, to District Manager, SEEBOARD, 56, Chapel Road, Worthing, by 17th December, 1958.

GEORGE WRAY,
Secretary.
5698

HEAD WRIGHTSON IRON & STEEL WORKS ENGINEERING LTD.

ASSISTANT CIVIL ENGINEER required for Resident Engineer's staff on large development contracts in the iron and steel industry. Applicants should have a degree or be Graduate Members of the Institution of Civil Engineers and experience of structural steelwork erection would be advantageous.

Applications should state age, experience, qualifications and salary required to The Personnel Manager, Ref. IS/22, Teesdale Iron Works, Thornaby-on-Tees.

5699

ELECTRICAL ENGINEERS

required for Engineering Department of Automatic Motor Control Gear Makers in West Midlands.

The work comprises the derivation of schematic diagrams, selection and layout of components and issue of works manufacturing instructions.

A pension scheme is in operation and assistance towards removal expenses will be paid in approved cases.

Apply in confidence stating age, experience and salary required to—Box 5590.

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

(1) Fourth Assistant Engineer (Construction)
(2) Fourth Assistant Engineers (Test)
(2 Vacancies)

APPLICATIONS are invited for the above appointments. Applicants should possess the necessary technical qualifications and have had a sound engineering training. The salaries and conditions of service will be in accordance with the National Joint Board Agreement, Schedule A, the present classifications, gradings and salaries will be as stated below. The posts are superannuable subject to satisfactory evidence of health.

(1) FOURTH ASSISTANT ENGINEER (Construction).

Candidates should have had experience in construction work appertaining to a large distribution system, including experience with underground cables, H.V. O.H. line work and building of substations. The classification and grading is L.13, salary £835/£880 per annum.

(2) FOURTH ASSISTANT ENGINEER (Test), Area Transformer and Protection Test Dept., Motherwell (Two Vacancies).

Candidates should have had experience in the testing, commissioning, maintenance and repair of modern protective equipment and instruments. They should be conversant with voltage drop and short circuit calculations and have had some experience of H.V. fault location. The classification and Grading is L.13, salary £835/£880 per annum.

The successful candidate for each of these appointments will require to reside within a reasonable distance of their respective offices.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Crescent,
Hamilton. 5682

JOSEPH LUCAS (ELECTRICAL) LIMITED

Great King Street, Birmingham, 19

ENGINEER

EXPANSION of development of ignition equipment for gas turbines and allied projects creates a vacancy for a practical engineer with experience of design for economic production of electrical apparatus. The work is of a high technical standard and applicants should preferably possess an honours degree.

The post is permanent and pensionable and offers considerable scope for advancement to a progressive engineer.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, 19, quoting reference PM/D/190.

128

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division
Vacancy No. 130/ER/58

APPLICATIONS are invited for the superannuable N.J.B. position of ASSISTANT SHIFT CHARGE ENGINEER at ROGERSTONE POWER STATION, Nr. Newport, Mon.

Salary G.8, £885-£930 per annum.

Applicants should possess H.N.C. or equivalent qualifications and have had experience in a modern power station.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 15th December, 1958. 5687

MID AND SOUTH EAST CHESHIRE WATER BOARD

ELECTRICAL ENGINEER (Higher National Certificate) is required at the new filtration station of the Mid and South East Cheshire Water Board at Hurleston, Near Nantwich, Cheshire. As Station Superintendent he will be responsible for the operation of these works which provide first-class opportunities for learning advanced waterworks practice, employing modern techniques.

Applicants must have served a proper apprenticeship, be active, capable of directing small group of operatives (10), to plan maintenance, possess qualifications equivalent to the Higher National Certificate and have had much experience in the maintenance of electrical equipment. Mechanical experience of prime movers will be an advantage. Full training in the specialised techniques will be given.

Salary £900 p.a., new house at low rent of £1 per week in pleasant surroundings near attractive town of Nantwich. Superannuation.

Application form from Delwyn G. Davies, Engineer and Manager, Weaverham Grange, Hartford, Northwich, Cheshire. Closing date Monday, 15th December, 1958. 5694

CITY OF SHEFFIELD

Assistant Engineer (Electrical)

APPLICATIONS are invited for the above post in the Department of the City Architect, on A.P.T. Grade II, salary £725 to £845 per annum.

Applicants should have had a sound technical training, some knowledge of installation practice in large buildings, and preference will be given to those possessing the Higher National Certificate in Electrical Engineering or the equivalent.

They should be good draughtsmen and capable of preparing drawings and specifications under limited supervision.

Applications, stating age, qualifications and full details of previous experience, with the names of two referees, should reach the undersigned by the 15th December, 1958.

JOHN HEYS,
Town Clerk.

Town Hall,
Sheffield, 1.
5th December, 1958. 5673

LONDON ELECTRICITY BOARD

Demonstrator

APPLICATIONS are invited for the above position in the Board's North Western District, based initially at Hampstead, London, N.W.3.

Applicants should be suitably qualified, holding the E.A.W. or other approved certificate including electrical housecraft, and having experience in conducting demonstrations at service centres and in general service centre duties. They should also be experienced in advising consumers on the selection and use of domestic appliances, both at the service centre and on consumers' premises.

The post is graded within the N.J.C. Agreement (Administrative and Clerical Grades) as Grade 1, i.e., £550/£665 per annum, inclusive of London area allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2. Please quote ref. PER/2554/R. 5660

LONDON ELECTRICITY BOARD

Senior Draughtsman

APPLICATIONS are invited for the above position in the Board's Western District. Initially the successful candidate will be located at Fulham, but subsequently will be required to work at Shepherd's Bush.

Applicants must have a good experience of building construction and simple reinforced concrete structure work. They should have a knowledge of electrical plant layout, a good general and technical education up to Ordinary National Certificate standard, and be able to prepare system diagrams, etc.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 5, £800 to £910 per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 13th December, 1958. Please quote ref. PER/2562/R. 5648

ASHLEY ACCESSORIES LIMITED

Ulverston, Lancashire

MANUFACTURERS of mass production ELECTRICAL WIRING ACCESSORIES AND ASSOCIATED PRODUCTS in a modern plant situated in the Lake District.

The following appointments, which are due to expansion in the design team, carry good salaries and prospects. Housing will be available, together with settling-in allowance and optional pension scheme.

(1) CHIEF ELECTRICAL DRAUGHTSMAN.
To take an active part in the work of design from initiation of an idea on the drawing board with liaison through laboratory to production stages. The work calls for keen interest in the field of design for large quantity production.

(2) ELECTRICAL DESIGNER-DRAUGHTSMEN.
Able to develop ideas on the drawing board and take an active interest in the associated laboratory work.

All applications will be treated in strict confidence and should be addressed to Chief Engineer.

5678

LECTURING APPOINTMENTS AT ROYAL MILITARY ACADEMY, SANDHURST

(a) TUTOR IN MILITARY HISTORY (pensionable post).
(b) LECTURERS or SENIOR LECTURERS in SCIENCE (2-3 posts), MODERN SUBJECTS (2-3 posts) and MATHEMATICS (1 post) (short service posts with prospect of promotion and permanent service).

Men aged at least 21 on 1st January, 1959, may apply. Superannuation rights preserved.

Qualifications: (a) Normally 2nd Class Honours Degree covering Military History, high professional attainment as a military historian or extensive knowledge of the development of the Armed Forces gained in senior service appointments; (b) Normally 2nd Class Honours Degree in appropriate subjects. Teaching experience essential for (a) and desirable for (b).

Starting salary: (a) £1,550 (or above) rising to £1,950; (b) appointment according to age, qualifications and experience; starting salary £590 (or above) rising to £1,065; or £1,080 (or above) rising to £1,145.

Write Civil Service Commission, Burlington Gardens, London, W.1, quoting 4911/58/10. Closing date 16th December, 1958. 5652

DESIGN & STANDARDS ENGINEER

Age 27 - 35

required for progressive company manufacturing a wide range of Domestic Electrical Appliances. Applicant must possess a recognised professional qualification. Extensive design and manufacturing experience in the light engineering field essential; successful applicant must be capable of controlling Material and Labour Standards and Inspection Dept., and must have a critical and constructive knowledge of tool-making.

The post offered is a permanent one and carries superannuation and sick and benevolent entitlements.

Commencing salary £1,250 rising to £1,500 p.a.

Apply in writing only giving details of age, education and experience, together with copy reference, to :—

The Managing Director
AIBHLEISI EIREANNACHA TEORANTA
Dunleer, Co. Louth

5604

Situations Vacant (continued)

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following posts :—

FOURTH ASSISTANT ENGINEERS, SYSTEM OPERATION DEPT., THAMES NORTH GRID CONTROL.

Salary Class AX/EX, Grade 8, £710 × £25 to £835/£935 per annum.

Applicants should have qualifications to Higher National Certificate standard and should be prepared ultimately to undertake shift duties in the Area Grid control room. Some steam generating station experience is desirable.

Forms of application AE.6/ACT may be obtained from the Board's Headquarters, or from any Divisional Offices of the Board, and should be addressed to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts, to arrive not later than 13th December, 1958.

W. N. C. CLINCH,
Controller. 5676

MINISTRY OF SUPPLY

TECHNICIAN required at Harefield, Middlesex, to assist in making precise measurements of electrical quantities in connection with the test and calibration of test apparatus, in the ultra high frequency and micro wave fields. Also to assist more senior staff in development of new measuring techniques and apparatus for the above fields.

Qualifications: Recognised electrical engineering apprenticeship or equivalent training in appropriate trade. An aptitude for and interest in experimental laboratory work. Possession of O.N.C., appropriate City and Guilds Final Certificate or equivalent qualification is desirable.

Salary £695 (age 26) to £870 p.a.

Application forms from Ministry of Labour and National Service, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4, quoting P.E. 2080. Only applicants selected for interview will be advised. 5674

MINISTRY OF SUPPLY

TECHNICIAN required at Harefield, Middlesex, to carry out measurements of fundamental electrical quantities and on the properties of test apparatus in the audio-frequency and V.H.F. fields. Assisting in the development of new electrical measuring techniques and apparatus in the above fields.

Qualifications: Recognised engineering apprenticeship or equivalent training in an appropriate trade. Ability to do experimental work and have had practical experience in at least one of the fields of duties is essential. Possession of O.N.C., appropriate City and Guilds Final Certificate, or equivalent qualification, is desirable.

Salary £870 (age 30) to £1,030 p.a.

Application forms from Ministry of Labour and National Service, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4, quoting P.E.2081. Only applicants selected for interview will be advised. 5675

ROYAL TECHNICAL COLLEGE, SALFORD

Department of Electrical Engineering

REQUIRED, as soon as possible, an ASSISTANT LECTURER. The department is growing rapidly and is entirely housed in new buildings, well equipped both for teaching and research.

The appointment now offered might prove attractive to one who has recently graduated, as only teaching at advanced level is involved and the holder would be expected to take an active interest in research development.

Salary offered is £650 × £25 to £1,025, supplemented by statutory additions for training, industrial or teaching experience.

Further particulars and application forms may be obtained from the Registrar, Royal Technical College, Salford, 5.

R. RIBBLESDALE THORNTON,
Clerk to the Governors.
5661

JOSEPH LUCAS (ELECTRICAL) LIMITED

ASSISTANT ELECTRICAL DESIGN ENGINEER

required for the design of rotating electrical machines and electro-magnetic devices. Projects will include fundamental design investigations, and full scope will be given for initiative and imagination.

The post is permanent and pensionable.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Limited, Great King Street, Birmingham, 19, quoting reference PM/D/221.

125

MIDDLESEX COUNTY COUNCIL

Architect's Department

ELECTRICAL ENGINEER, A.P.T. IV, £1,055-£1,205 p.a., to act as leader of small section. Must have considerable experience in all branches of electrical installation work and be competent draughtsman for preparation of schemes and contract drawings and specifications covering large public buildings.

ELECTRICAL ENGINEER, A.P.T. III, £875-£1,055 p.a. Must be competent draughtsman for preparation of schemes, contract drawings and specifications for electrical wiring of large buildings.

Salaries according to qualifications and experience. Established. 5-day week. Prescribed conditions.

Application forms (s. a. f'cap e.) from County Architect, 1, Queen Anne's Gate Buildings, Dartmouth Street, London, S.W.1, returnable by 17th December. Canvassing disqualifies. 5651

DESIGN ENGINEERS

DESIGN ENGINEERS who would be interested in joining a small and enthusiastic team engaged in the development of Submersible Electric Motors and in the application of electronic principles to the automatic control of electronic power supplies, etc., required by Stone-Chance Ltd., of Crawley, Sussex.

Aptitude and the ability to think originally, with a desire to work in the personal atmosphere of a medium-sized firm, are as important as academic qualifications.

A younger man would be preferred but not essentially. The salary offered would be related to the experience of the individual selected.

Applications, which will be treated in confidence, should be made to the Managing Director. 5656

CORPORATION OF WILLESDEN

Electrical Engineering Assistant

APPLICATIONS are invited for the appointment of:—

ELECTRICAL ENGINEERING ASSISTANT, salary within Special Grade £750-£1,030 p.a.

London weighting, maximum £30 p.a. is payable in addition to the above salary.

Candidates should possess appropriate qualifications and should have experience in the design of electrical equipment and installation.

The council cannot assist with housing.

Full details and form of application may be obtained from the Borough Engineer and Surveyor, Town Hall, Dyne Road, Kilburn, London, N.W.6, and must be returned to the undersigned not later than 9 a.m. on Monday, 15th December, 1958.

R. S. FORSTER,
Town Clerk.
20th November, 1958. 5625

AIR MINISTRY WORKS DESIGN BRANCH

requires in LONDON and PROVINCES

ELECTRICAL ENGINEERING DRAUGHTSMEN

experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution, H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage.

Salaries in LONDON up to £1,015 p.a. Somewhat lower in PROVINCES. Starting pay dependent on age, qualifications and experience. Long-term possibilities with promotion and pensionable prospects.

5-day week; 3 weeks 3 days leave a year. Liability for overseas service. Normally naturalborn British subjects.

Write stating age, qualifications, employment details, including type of work done, to any Employment Exchange, quoting Order No. Borough 104. 399

ELECTRICAL PORCELAIN

INSULATOR ENGINEER for special duties on high voltage insulators, technical liaison and development. Sound electrical engineering background with degree or H.N.C. preferably experience on transmission, switchgear or transformers. Must have initiative and be good mixer. Salary about £800 p.a. excellent prospects.

ESTIMATOR for tendering work on porcelain insulators. Experience on transmission, distribution and knowledge of electrical engineering. Salary £700-£1,000 depending on qualifications.

DOULTON INDUSTRIAL PORCELAINS LTD.
Ref. M.C.B.
Doulton House
Albert Embankment
London, S.E.1 5700

M.K. ELECTRIC LIMITED

REQUIRE EXPERIENCED SALES REPRESENTATIVE FOR NORTH EAST ENGLAND

If you have experience in dealing with architects, electrical wholesalers and contractors, are a car owner and would like to join the sales team of a progressive company marketing products with a world-wide reputation, we would like to hear from you in confidence.

Write in the fullest detail to:—
The Sales Manager
M.K. ELECTRIC LTD.
London, N.18

5580

NORTH EASTERN ELECTRICITY BOARD

Tyne Sub-Area

APPLICATIONS are invited for the appointment of two SENIOR SERVICE CENTRE ASSISTANTS at Carliol House Service Centre, Newcastle.

Previous sales experience and a high standard of salesmanship ability required. Salary Grade 2, £640/£700. N.J.C. conditions of service.

Applications stating age, qualifications and experience to be received by the Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within seven days of the appearance of this advertisement. 5695

DRAUGHTSMAN FOR HIGH-TENSION SWITCHGEAR

THERE is a vacancy in our modern drawing offices for a draughtsman with experience of 11-kV switchgear.

The position offers a five-day week and the advantages of a non-contributory pension scheme.

Apply in writing, giving full details, to :—
The Personnel Manager
GEORGE ELLISON LIMITED
Perry Barr, Birmingham, 22b

5663

LONDON ELECTRICITY BOARD

Engineering Draughtsman

APPLICATIONS are invited for the above position in the West Bourne District, based at South Kensington, London, S.W.7.

Applicants should have had a good general and technical education up to the Ordinary National Certificate standard, and should preferably have had experience in one or more of the following: electrical plant layout, mains survey and recording of mains work, building construction, drawing office routine.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 6, £635 to £755 per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 12th December, 1958. Please quote ref. PER/2551/R. 5600

ELECTRICAL ENGINEER

required for London area by
STURTEVANT ENGINEERING Co. Ltd.
Southern House
Cannon Street
London, E.C.4

Age 25-35. Works apprenticeship and H.N.C. (Electrical) essential. Must have experience in preparation of specifications and wiring diagrams and be fully conversant with the estimating and application of motors and control gear and associated equipment.

Contributory pension scheme; 5-day week.

Apply in writing, giving particulars of age, education and experience to Staff Engagements Officer at above address, marking letter "E.E." 5701

WORKS ENGINEER

WE are looking for a University Graduate or Member of a Professional Institution to take complete charge of the maintenance of the offices and factories throughout our organisation.

The duties include responsibility for electrical layout and boilers serving heating systems and entails the control of building maintenance workers, bricklayers, plumbers, painters, carpenters and electricians.

This is a senior appointment carrying with it a good salary and participation in a non-contributory pension scheme.

Please send full particulars including age, experience and salary requirements to—

The Personnel Manager
GEORGE ELLISON LIMITED
Perry Barr, Birmingham, 22b
5653

EASTERN ELECTRICITY BOARD

Chilterns Sub-Area

Sub-Area Engineer's Department

THIRD ASSISTANT ENGINEER (Planning and Development) (127/58.R.). Candidates should have had a sound technical training and experience in the planning and construction of large urban and rural distribution systems, including substations, at voltages up to 33 kV.

Salary N.J.B. Class L, Grade 10 (£995-£1,055).

Apply by letter to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend Street, Bedford, by the 19th December, 1958. 5689

ASSISTANT electrical engineer required by steel tube manufacturers in Birmingham, to be responsible for all electrical maintenance and repairs, including a large number of overhead cranes and other lifting appliances, total over 7,000 kVA. Applicants must be between the ages of 24 and 30, have a university degree or equivalent, and have served a recognised apprenticeship or training for at least 3 years in electrical engineering. Contributory pension scheme. Apply stating age, qualifications, experience and salary required to the Personnel Manager, Tubes Limited, Rocky Lane, Aston, Birmingham, 6. 5646

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

SHIFT CHARGE ENGINEER, SOUTHAMPTON GENERATING STATION SEC/3.7). Applicants should have had previous experience in a generating station and preferably have had manufacturing works experience. Preference will be given to those possessing qualifications admitting to corporate membership of a recognised professional engineering institution.

Salary N.J.B. F/7, £885-£930 plus 10% shift allowance.

Special application forms obtainable only from P. D. A. Oliver, Divisional Secretary, Central Electricity House, High Street, Portsmouth, should be returned by 17th December, 1958. 5688

A CHARGE hand for expanding electric motor repair works. Experience of all types of winding and fitting including outside service. Able to drive. Good rate and opportunity for keen and industrious man.—Lewis Electric Motors Ltd., Moor Works, Blackamoor Lane, Maidenhead, Berks. 5547

ASSISTANT to electrical engineer required, handling selection of motors, control gear, etc., associated with company's mechanical products and supplying necessary tendering information on electrical matters, including estimating of electrical installation for outworking contracts (mainly pumping stations). Some previous experience desirable in this field, also of dealing with electrical suppliers and installation contractors. Will be required to give general assistance in company's works maintenance department. Good opportunity for man aged about 25 with basic qualifications to broaden experience. Full details to Secretary, Tangyes Limited, Cornwall Works, Smethwick. 5704

BRENTFORD TRANSFORMERS Ltd. have a vacancy for a senior sales engineer. The position which is well paid and offers chance of promotion, pension scheme and local accommodation, is open to a man with a good engineering knowledge in the control and rectifier field. A certain amount of organising ability is also required. Applications to—Sales Director, B.T.L., Manor Royal, Crawley, Sussex. 5705

CABLE estimator required in London. Experience in rubber and plastic cable design and estimating. Age 20/25. Write full details in strict confidence to—Box ER.904, c/o 191, Gresham House, London, E.C.2. 5564

CABLE estimator with experience in paper mains cable design and costing required in London. Age 25/30. Write in strict confidence, stating experience and salary required, to—Box ER.905, c/o 191, Gresham House, London, E.C.2. 5563

CIRCUIT engineer. Young man, age 22/26, required for circuitry work associated with automatic control gear. O.N.C. standard preferred. Permanent and progressive position. Pension scheme. Canteen. Apply in writing giving full details of age, experience and qualifications, if any, to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Rd., Hounslow, Middlesex. 5593

CONSULTING engineers have vacancy for an assistant electrical engineer to be attached to their Inverness office on site work associated with hydro-electric power plant and main transmission substations. A young engineer age 25-30 years, having a degree or equivalent qualification and some practical experience of power engineering, is required. Applicants please submit details of training and experience to—Kennedy & Donkin, 3, North Charlotte Street, Edinburgh, 2. 5706

DESIGNER draughtsman. Due to expansion, opening occurs for better than average engineer to join enterprising and enthusiastic team in design, pricing and site execution of electrical installations for all classes of buildings. Creative mind and accuracy essential for this interesting and high calibre work. Write full particulars of experience, age, training and salary required—(M.D.), Alliance Electrical Co. Ltd., 2, Henrietta Street, London, W.C.2. 65

ELECTRIC cable manufacturer requires energetic sales representative for South London and South-East England. Applicants should possess sound education, proved selling ability and preferably experience in the thermoplastic cable trade. Apply giving fullest details and salary required, in strict confidence to—Sales Manager, Permanoid Ltd., New Islington, Manchester, 4. 5716

ELECTRIC lamp manufacturer has vacancies for representatives in Lancashire and in the Midlands. Replies with full details of experience, age, salary required to—Box 9544.

ELECTRICAL engineer required for liaison between design department and works. Automatic control experience essential. Rotating machinery experience advantageous. Progressive position with expanding company situated thirty miles north of London. Housing assistance given after probationary period. All replies treated in strictest confidence and answered.—Box 5702.

ELECTRICAL engineering draughtsman required for work on A.C. and D.C. control gear. Must be familiar with all types of circuit diagrams. First-class working conditions in new modern premises, canteen, pension scheme and 5-day week. Apply in writing—M.T.E. Control Gear Ltd., Leigh-on-Sea, Essex, stating age, experience and present salary. 5679

ELECTRICAL engineers required, to act as technical sales representatives for an expanding Manchester firm of light electrical engineers. Vacancies exist for engineers based in the London and Manchester areas. The essential qualifications for these posts are a broad engineering background, technical qualifications for these posts are to at least O.N.C. level and the ability to mix with people of all walks of life. Applications, including academic and career histories, should be sent to—Box 5664.

ENGINEER, experienced steel tower work and foundations essential. Good prospects. Electrical engineers and contractors. Pension scheme.—Box 5503.

ENGINEER (20/25) to assist service/sales engineer required by leading Midland furnace manufacturing company for their London division. Applicants should have served a recognised electrical engineering apprenticeship, preferably with mechanical background. Details of qualifications and experience in the first instance to—Box 5654.

FOREMAN electrician required for contractors and retailers in Cambs. district. Must have thorough knowledge of trade, ability to organise and control labour. Age not over 35. Write giving full details, salary expected and current references to—Box 9560.

LECTURER in electrical engineering required at South-East London Technical College (Department of Electrical Engineering and Applied Physics). Should possess a degree, have had suitable industrial experience. Facilities for approved research are available. The college offers full-time diploma, full-time courses for Part III I.E.E. examination, sandwich courses, part-time day and evening courses in electrical engineering and applied physics. Salary within the scale £1,236 × £30 to £1,398 according to age and experience. Application forms from the Secretary, South-East London Technical College, Lewisham Way, London, S.E.4, to be returned by 20th December, 1958. (2303) 5650

MANAGER, experienced sales and electrical installations. Sussex area. Good prospects. 30-35. Pension scheme.—Box 5502.

PIRELLI-GENERAL CABLE WORKS Ltd., Southampton, require additional senior rubber and plastics technologists, preferably with previous experience in the cable making industry. The salaries offered will be commensurate with qualifications and experience. Apply, giving full details of age, education and past experience, to the Staff Officer. 5690

PUBLICITY. Applications are invited from men capable of handling the publicity of a firm manufacturing switchgear and transformers. Publicity experience essential, and preferably some electrical engineering training. Offices situated in Wilmslow (14 miles south of Manchester). Replies, which will be treated in confidence, to Branch Manager, South Wales Switchgear Ltd., Rex Buildings, Wilmslow, Cheshire. 5665

REPRESENTATIVES, experienced, car owners, selling decorative and commercial lighting fittings to the trade, stores and wholesalers. Good salary, commission and expenses. Areas: (1) London and S. Suburbs; (2) West of England; (3) N. and S. Wales; (4) Scotland; (5) The 4 Northern Counties. Write with full particulars to—Box 5562.

SENIOR contracts engineer required by London contractor. Experienced in general electrical contracting, cabling, switchgear and plant installation. Pension scheme. Permanent. Prospects. Particulars in confidence to—Box 5657

Situations Vacant (continued)

SALES order clerk (male) required by lighting specialists. Apply—Secretary, Ensel Electric Co. Ltd., 3, Eden Grove, London, N.7 (North 5866). 5707

SALES representative required as assistant to London manager old-established electrical mechanical engineers. Sales experience not essential. Should be conversant with crane or electric motor control gear preferably with some mechanical experience. Age 24 to 30. Salary, commission. Pension scheme. Car provided.—Box 9565.

SALES representatives required to promote sales of fluorescent fittings on commission basis.—Box 9551.

SENIOR electrical designer-draughtsman required by expanding and progressive firm of electrical engineers manufacturing control panels, switchboards, engine-driven generating sets, distribution fuseboards and power rectifier equipment. This appointment offers a fine opportunity for advancement to an electrical designer having a wide general knowledge. A substantial salary is offered to a designer with appropriate experience. The company's premises are situated in an interesting part of the South Coast. Reply to Managing Director, Box 5666, stating age, salary and experience.

SUPERVISING and estimating engineer required immediately by established electrical contractors in the Midlands. Flat available. Apply stating experience and salary required.—Box 9550.

SUPERVISING electrical engineer required by Manchester firm of electrical contractors. Excellent prospects for the right man. Give full details of age, experience and salary required to—Box 5667.

SUPERVISING electrical engineer required for S.W. London electrical contractors. Duties to include supervision of contracts, estimating, preparation of schemes (including underfloor heating) for council, private and industrial works. Replies, which will be treated in the strictest confidence, giving fullest particulars of age, experience and salary required, to Box 5715. All applications will be acknowledged.

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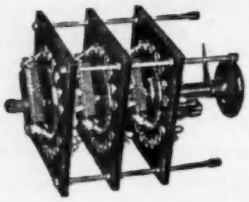

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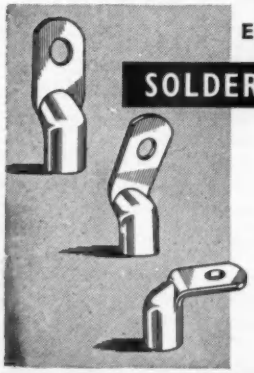

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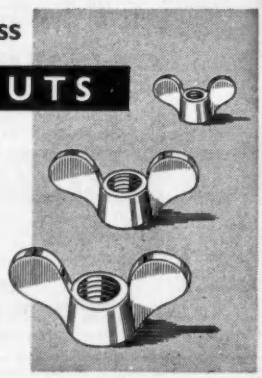

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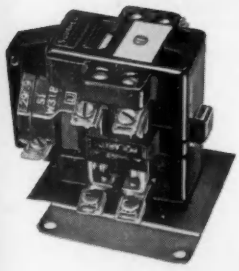

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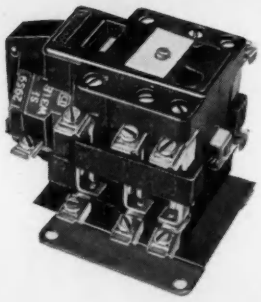

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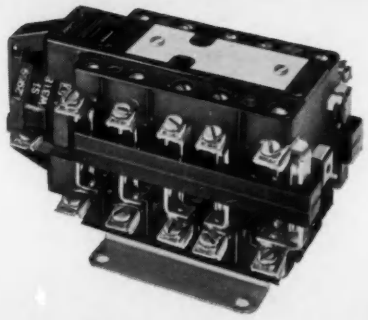

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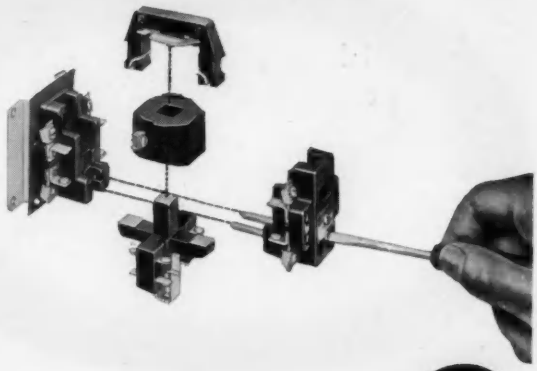

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